THE EFFECTS OF FAMILY HISTORY ON PATIENT HEALTH BEHAVIOR: AN EXAMINATION OF YOUTHS WITH TYPE 1 AND TYPE 2 DIABETES

By

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This document is dedicated in loving memory, to my father, Waymond Roscoe Aker, Sr.
(May 24, 1941 – July 03, 1998).

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By

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Major Department: Clinical and Health Psychology

Compliance rates for chronic disease regimens are poor and are estimated to be approximately 50%. It appears that family history of disease is a likely explanatory factor that has been overlooked, as family history of disease has rarely been examined for its influence on patient health beliefs and health behavior. Additionally, the emergence of Type 2 diabetes in ethnic minority youths is a recent development. This study sought to gain descriptive information about youths with Type 2 diabetes in comparison to youths with Type 1 diabetes. Additionally, the study also investigated the role of family history on patient health behavior and beliefs by testing a General and Domain-Specific Model.

The sample population consisted of youths having Type 1 or Type 2 diabetes for at least one year and ranging in age from 12-21 years. All subjects had a positive family history of diabetes. Youths were approached during routine diabetes clinic visits. Informed consent/assent was obtained. Three telephone interviews were conducted, including one structured interview pertaining to the family health behavior and three 24-hour recall interviews to assess the patients' daily diabetes management behaviors.

Stereotypical differences in BMI and ethnicity between youths with Type 1 and Type 2 diabetes were evidenced. Health beliefs were uniform among the youths. Having the same type of diabetes as the selected family member optimized the amount of diabetes-related knowledge the youth had about the relative. The participants demonstrated hesitancy to appropriately associate macrovascular and microvascular morbidity to diabetes, strongly suggesting a need for improved education. Likewise, the data also suggested confusion about the American Diabetes Association's recommended guidelines for diet, as strong health beliefs were associated with negative health behavior on several occasions.

The tested family history terms were significant over several of the outcome variables. Additionally, the family history variables often demonstrated complex relationships with other variables through interactions. While neither the General nor Specific Model demonstrated a clear superiority over the other, the usefulness of family history in the prediction and understanding health behavior of patients was supported.

CHAPTER 1
INTRODUCTION

Diabetes: An Overview

Diabetes is not just one disease but rather a cluster of related syndromes that share common characteristics. The similarities include the presence of hyperglycemia (elevated blood glucose levels) and glycosuria (the presence of glucose in the urine) (Poldolsky & Viswanathan, 1980). There are two main types of diabetes. Type 1, or insulin dependent, diabetes may also be referred to as juvenile onset diabetes as the typical age of onset is prior to age 30. Type 1 diabetes is also characterized by the need for external sources of insulin to sustain life, as the body is unable to produce sufficient insulin. Type 2, or non-insulin dependent, diabetes is often referred to as adult-onset diabetes, as the typical age of onset is greater than 40 years with a mean of 55 years of age (Haire-Joshu, Flavin & Clutter, 1986). Type 2 diabetes is the most prevalent of the diabetic conditions, accounting for the vast majority (approximately 90%) of all cases. In the general US population, about 7.8 million individuals are currently living with diagnosed Type 2 diabetes (Mokdad, Ford, Bowman, Nelson, Engelgau, Vinicor, & Marks, 2000).

Type 2 diabetes is different from Type 1 diabetes not only in its typical age of onset and prevalence but also in its disease management. All Type 1 patients need injections of external insulin for metabolic control. On the other hand, the majority (57%) of adults with Type 2 diabetes do not require insulin injections, as their bodies continue to produce and use insulin, although less effectively than normal (Haire-Joshu el al., 1986). In many instances, oral medications are used in the Type 2 population. Primary management techniques for Type 2 diabetes center around employing strategies that enhance the body's ability to use naturally occurring insulin. The most prominent methods include weight management through dietary considerations and increased exercise (NIH, 1995).

Type 2 Diabetes in Youths

Although Type 2 diabetes has been characterized by its adult age of onset, recently there has been increased manifestation of Type 2 diabetes among children and adolescents (Fagot-Campagna, Pettitt, Engelgau, Burrows, Geiss, Valdez, Beckles, Saaddine, Gregg, Williamson, Narayan, & Venkat, 2000; Glazer, 1997). This intrusion of what is typically an adult-type of diabetes into younger populations is sometimes referred to as non-insulin dependent diabetes in youths (NIDDY). An investigation at a Midwestern diabetes clinic by Pinhas-Hamiel et al. (1996) found that rates of Type 2 diabetes among children between the ages of 10 to 19 increased tenfold from 0.7/100,000 to 7.2/100,000 over a ten-year period. Despite only recent recognition of this condition in youths, there is mounting evidence that this increased incidence of NIDDY is not an isolated event (Macaluso, Bauer, Deeb, Malone, Chaundhari, Silverstein, Eidson, Goldberg, Gaughan-Bailey, Brooks, & Rosenbloom, 2002). Similar patterns are occurring throughout the country and internationally, as our youth are engaging in more sedentary lifestyles and poorer dietary practices resulting in increased obesity (Sorof & Daniel, 2002; Gidding, Bao, Srinivasn, & Berenson, 1995; Campainge, Morrison, Schumann, Falkner, Lakatos, Sprecher, & Schreiber, 1994).

The etiology of NIDDY appears to be very similar to that of typical Type 2 diabetes. The primary risk factors for youths mirror those found in adults: obesity, a positive family history of diabetes and membership in an ethnic minority group (Fagot-Campagna et al., 2000). Adult studies demonstrate differential prevalence rates across ethnicities. Native Americans, Hispanic Americans, and African Americans generally demonstrate significantly higher occurrences of Type 2 diabetes than Caucasian Americans (NIH, 1995). Likewise, specific studies have been conducted identifying significantly higher rates of NIDDY within African Americans, Mexican Americans, Native Americans, and Japanese populations (Jones, Clemons, & Gottschalk, 1999; Kitagawa, Owada, Urakami, & Tajima N, 1994; Pinhas-Hamiel et al., 1996). However, a number of factors make it difficult to assess the exact prevalence rate of NIDDY. In addition to little attention being given to the disorder until recently, it is estimated that half of all Americans who have Type 2 diabetes are undiagnosed, as individuals may be asymptomatic for months to years (Harris, Klein, Welborn, & Knuiman, 1992). For this reason, complications associated with long-term diabetes, usually retinopathy, are often already present at diagnosis (Haffner et al., 1988; Klein et al., 1984; Harris et al., 1992). The tendency to have an initial asymptomatic period makes it difficult to assess Type 2 diabetes in adults and children. In fact, the diagnosis of Type 2 diabetes in youths is often made in a serendipitous manner, as hyperglycemia or glycosuria are accidentally found in blood or urine samples (Pinhas-Hamiel et al., 1996). Additionally, misclassification of Type 2 diabetes as Type 1 at disease onset also clouds the picture. Until recently, it was not widely accepted that Type 2 youths could initially present as insulin-dependent, with ketoacidosis, only to later settle into a typical Type 2 profile (Sellers & Dean, 2000; Matthews & Wallace, 2002).

Diabetes in Ethnic Minorities

The increasing prevalence of diabetes among younger populations is of particular concern as diabetes is already among the most common chronic diseases within the United States, along with ischemic heart disease, stroke, cancer and chronic obstructive pulmonary disease (COPD) (CDC, 1999). Minority groups consistently demonstrate increased mortality for all leading chronic diseases except COPD. Examination of age adjusted mortality rates for ethnic minorities in comparison to Caucasian Americans reveals the most discrepant mortality rates for patients with diabetes. Minority patients with diabetes have an average mortality rate of 26.3 per 100,000 compared to the 15.9 per 100,000 among their Caucasian American diabetic counterparts (CDC, 1999). Among the minority groups investigated (African Americans, Native Americans, Asian Americans, and Hispanic Americans), African Americans exhibit the highest mortality rates for diabetes-related deaths at 39.1 per 100,000 (CDC, 1999). Common causes of diabetes-related morbidity include cardiovascular disease, retinopathic blindness, kidney failure, amputation of extremities, and infections. Prevalence of morbidity is associated with duration of illness and adequacy of diabetic control (Haffner, Fong, Stern, Pugh, Hazuda, Patterson, Van Heuven, & Klein, 1988; Klein, Klein, Moss, Davis, & DeMets, 1984).

Compliance Problems in Diabetes

Noncompliance is a major factor that contributes to mortality and poor disease management. Patient compliance rates for all chronic conditions are poor, averaging 50% (Haynes et al., 1979). However, compliance rates vary across patients, and they vary across the different components of disease management. Diabetes care, for example, requires numerous behaviors including oral medication or insulin administration, blood glucose monitoring, dietary restrictions, weight management, and physical activity. For example, in youths with Type 2 diabetes, less than 10% are treated with diet and exercise alone (Kaufman, 2002). A number of studies focusing on adherence to the various facets of treatment suggest that compliance rates are mediocre at best. One study examining Type 2 adults revealed that only 40% of those surveyed reported monitoring their blood glucose levels at least once a day (Harris, Cowie, & Howie, 1993). This same study revealed that African Americans were 60% less likely to perform daily blood glucose tests than Caucasian Americans. In pediatric populations, similar noncompliance rates have been reported. African American youths have been found to be less compliant and in significantly poorer metabolic control than Caucasian American youths (Auslander, Thompsom, Dreitzer, White, & Santiago, 1997; Delamater et al., 1991; Hanson et al., 1987). It is evident that there is a need to elucidate the factors that both impede and facilitate adherence in the African American population. Although educational and behavioral strategies are the primary tools used to improve adherence, perhaps family history of diabetes plays a larger role in understanding health behavior than previously realized.

Family History in Diabetes

Beyond the increased representation of morbidity and mortality within ethnic minority populations, the presence of a positive family history is another commonality among the leading chronic diseases. Family history has been identified as a significant risk factor. Again, diabetes is at the forefront of the chronic diseases in demonstrating the importance of family history. Even when limited to parental history, 46% of adults diagnosed with Type 2 diabetes have a positive family history of the disease (NIH, 1995).

A closer examination of family history rates by race reveals that in 1989, parental history rates of adults with Type 2 diabetes were 42.5% for Mexican Americans, 44.7% for non-Hispanic Caucasian Americans, and 47.9% for non-Hispanic African Americans (NIH, 1995). Family history rates reported for children and adolescents with Type 2 diabetes appear to be even higher; 72 - 85% of Type 2 children have a family member with diabetes (Pinhas-Hamiel et al., 1996; Fagot-Campagna et al. , 2000).

It is well established that family history is an important variable in determining the susceptibility of any given patient to a number of diseases and conditions. Family history has been recognized as an important factor across multiple illnesses including hypertension, heart disease, cancer, and diabetes. However, it is unfortunate that most previous studies have taken a limited perspective on the role of family history, viewing it as a simple correlate or risk factor associated with a particular disease. Despite the importance of this variable, little attention has been given to elucidating the causal mechanism underlying the relationship between family history and disease onset. In particular, there has been little research examining the impact of family history on the actual health behavior of individuals who have been diagnosed with a particular disease or condition.

Possible Family History Mechanisms

Over recent decades, health care professionals have moved away from a strict biomedical model of disease and have adopted a biopsychosoical model (Engel, 1977). This shift in focus has allowed a broader perspective on the factors that contribute to disease, including biological, psychosocial, developmental, socio-cultural, and ecological factors. With this perspective comes acknowledgment that each patient is not merely an individual but a unit within a context which functions as part of a whole system, and the components within that whole affect each other.

Genetics

The mechanism by which a family history of diabetes increases a person's risk for disease is not entirely clear. A family history may result in a genetic predisposition to illness. Within Type 1 diabetes, high risk genes have been identified. Within Type 2 diabetes some hypotheses, such as the "thrifty gene," have been postulated. This theory proposes that there are genes, which remain unidentified, that promote energy storage and induce insulin resistance. The presence of such a "thrifty genotype" may have proven beneficial when feast and famine cycles were prominent because increased energy storage would leave a person more prepared when food was scarce (Ravussin & Bogardus, 1990). However, within modern times, many people rarely experience an unpredictable food supply. In the absence of these conditions, obesity, insulin resistance, and perhaps, Type 2 diabetes result. Nonetheless, we remain uncertain as to the identity of the genetic factors at fault and can only speculate as to their function. However, results from twin studies suggest a strong genetic component; concordance rates for identical twins with Type 2 diabetes range from 60- 90% (Newman, Selby, King, Slemenda, Fabsitz, & Friedman, 1987). The concordance rate for monozygotic twins with Type 1 diabetes is approximately 30% (NIH, 1995).

Health Behavior

Because biological or genetic issues are presumed to underlie the family history-disease onset link, the impact of family history from an environmental or behavioral standpoint has gone unexamined. The impact of family history may be a function of shared lifestyles and health beliefs between people who are in close proximity and relationship. The family may provide guidelines and models of behavior and act as a potential source of reinforcement and/or punishment for health behaviors. In addition, the family may also aid in the development of individual health cognitions and behaviors.

Gochman (1997) identified family health cognition as health cognitions that have relevance to the family and include beliefs and perceptions about illnesses and health procedures involving a family member. Behavioral expectations in relation to maintaining health or avoiding or coping with illness are also included. Two questions can be asked of the literature. From a broad perspective, what has been documented about the influence of general family health behaviors on the health behaviors of children and adolescents? More specifically, what have the few studies that have focused on family history within ill populations found?

The Impact of Parent Behavior on Child Behavior

The available literature suggests differential effects of parents on child health beliefs versus health behaviors. The evidence suggesting that parental health beliefs are related to child health beliefs is weak. For example, Dielmann et al. (1982) concluded that there are no significant relationships between parents' health beliefs and children's health beliefs. However, when the focus turns away from beliefs to actual health behaviors, a more convincing picture emerges. In the same Dielmann et al. study (1982) parental health behavior was identified as a significant factor in predicting child health behavior. In addition, several other studies have provided support for the impact of family behavior upon children. This influence has been observed across a variety of health behaviors, from seat belt and sunscreen use to smoking (Lau et al., 1990).

Smoking

Smoking has been one of the most frequently investigated health behaviors. The literature is fairly convincing in demonstrating that parental smoking influences adolescent smoking. For example, studies show that mothers who smoke are significantly more likely to have children who smoke (Nolte, Smith & O'Rourke, 1983; Doherty & Allen, 1994). In addition, Foshee et al. (1992) found that the likelihood that an adolescent smokes is not only dependent on having a parent who smokes but also on the adolescent's level of attachment to the parent; adolescents who were more attached to their smoking parent were more likely to smoke. Parental influence on youth smoking seems to persist throughout adolescence. Although peer groups emerge as increasing sources of influence during the teen-age years, most studies show that parental behavior continues to play a significant role in predicting smoking through the adolescent years into adulthood (Rossow & Rise, 1994; Lau et al., 1990; Dielmann et al., 1982).

While the above noted studies are helpful in demonstrating a general connection between parent and child health behaviors, none of them provide useful data about ethnic minorities. The samples used have been repeatedly labeled as non-representative by the authors themselves. Few studies have focused specifically on ethnic minorities. However, sources identified as most influential in smoking initiation have been shown to vary with respect to ethnicity. Sussman et al. (1987) reported that adult and peer models of smoking were found to be the strongest predictors of adolescent smoking in Caucasian Americans and Hispanic Americans. In contrast, risk-taking preferences in African Americans and poor school performance and low self-esteem in Asian Americans were identified as the most influential predictors of adolescent smoking. Other studies support that there are significant ethnic differences in the degree to which adults and peers may influence substance use (Newcomb & Bentler, 1986; Koepke, Flay, & Johnson, 1990).

Obesity, Dieting, and Exercise

While smoking is a disease-causing behavior, several behaviors viewed as disease-preventing have also received more attention as society becomes increasingly focused on health promotion. In areas that are related to diabetes and its management, the literature continues to provide data supporting the value of parental health behaviors on youth obesity, diet, and physical activity. For example, one prospective study showing the importance of the family unit as a source of modeling has also been repeatedly documented in relation to eating habits. Acceptance of most new foods does not occur instantly but rather only after the food is repeatedly presented. Liking for new foods generally increases after 5 to 10 exposures (Birch & Marlin, 1982; Sullivan & Brich, 1990). These findings emphasize the central importance of early experience with foods and food acceptance; children come to like eating familiar foods, and what is familiar is what parents provide within the family environment. Other data support the similarity of dietary patterns between children and parents. Oliveria and colleagues (1992) reported that youths' eating habits consisting of diets high in saturated fats are correlated with diets high in saturated fats among their parents. The foods that parents present within the home provide opportunities for children to incorporate those foods into their diets and thus, influence the child's dietary choices when outside of the home environment.

Family health behaviors influence what children eat but also what they do not eat. Pike and Rodin (1991) assessed the mothers of 9th - 12th grade girls; some of the girls were identified as eating disordered based upon their responses to the Eating Disorder Inventory (EDI). The sample consisted of mothers who were all white and from urban or suburban middle class homes. The data showed that mothers whose daughters were eating disordered were themselves more eating disordered. They reported more dieting (90% versus 79%) and dieting at significantly younger ages than mothers of girls who were not eating disordered. Furthermore, mothers of girls with disordered eating thought that their daughters should lose more weight than mothers of girls who were not eating disordered.

Again, many studies within this area fail to examine potential differences based upon ethnic minority membership. We know that there are race-related differences in dieting behaviors, as variations based upon race were identified in a population based study of adolescent female dieting, purging, and binge eating behaviors (French, Story, Neumark-Sztainer, Downes, Resnick, & Blum, 1997). In this study, a large number (17,159) of adolescent females completed a questionnaire. A representative ethnic minority sample was used. This study found that African American adolescents reported less frequent dieting and the lowest rates of bingeing. However, the data also demonstrated that the same factors contributing to majority culture dieting also produced increased dieting among minority adolescent girls. While differences in dieting based upon ethnic group membership have been documented, few studies speak to ethnic differences in parental influence on child/adolescent eating behavior.

The obesity literature also provides convincing evidence that parental and child obesity are linked. The probability that a child is obese increases significantly based upon how many parents are also obese (Garn & Clark, 1976). The same influence can be found in the physical activity literature. Gottleb and Chen's (1985) reported that parental exercise rates, as assessed by student report of parental exercise frequency, were significantly correlated to child physical activity level in a sample of 7th and 8th graders who were racially representative. Caucasian Americans were more physically active and participated in more individual non-competitive sports than African Americans. However, parental exercise rates were significantly related to the child's physical activity level regardless of race. In fact, there appears to be reasonable evidence of a dose-response relationship between the number of active parents (0, 1, 2) and activity levels in children (Romanella, Wakat, Loyd, & Kelly, 1991). However, some mixed results are reported as Godin, Shephard and Colantonio (1986) found no correlation between perceptions of parental exercise and the physical activity levels of 12˜ 14 year old children.

Parents versus Other Family Members

To date, the majority of research focusing on family history has identified parents, mostly mothers, as targets. Although an assumption may be made that parents, especially mothers, are likely to be the most influential adults in their children's lives, this assumption may be erroneous. The composition of the nation's family units continues to change. Family structures have been remodeled over the years to include various extended family members resulting in blended units, consisting of grandparents, stepparents, step-siblings, and other relatives. Review of census data accumulated over recent decades demonstrates this dramatic shift away from traditional nuclear families. From the 1960s to the present, the proportion of single parent children in the general population rose from 9% to 24%. For African American families, the increase was from 24% to 55% (Fields, 2001). In addition, the most recent census data show that 3.3 million children live in homes maintained by grandparents. The likelihood of living with one or more grandparent is also differentially affected by race, with rates being 12.3%, 5.6%, and 3.7% for African Americans, Hispanic Americans, and White Americans, respectively. With this shift in family structure, the possibly that family members other than parents are influencing children becomes more likely.

The importance of determining to whom the child is most connected and who therefore has the most influence on the child is an important issue. A theory proposed by Ewart (1991) suggests that the degree of interconnectedness between a model and observer is an important element in determining the magnitude of that model's influence. Interconnectedness is a term used to describe the degree of influence and shared experiences between the model and observer. The level of interconnectedness is likely to vary across family members. Therefore, having the participants identify their most influential family member lends more analytical power than simply assuming that the strongest model in the child's family is the mother or a parent.

Family History and Health Behavior in Diabetes

As one moves from examining the literature pertaining to general health behaviors to the literature examining health behaviors specific to prescribed medical regimens of ill patients, the scarcity of literature is evident. In fact, only two published studies focusing on family history and health behavior of patients with diabetes could be identified. The potentially strong impact of family history can be seen in one study focusing on Mexican Americans with diabetes (Hunt, Valenzuela, & Pugh, 1997). Most of the Mexican American patients interviewed for this study had several family members who had Type 2 diabetes and who had been prescribed insulin. Several patients reported that the decision to prescribe insulin seemed arbitrary. They described family members who had been very compliant with their oral medications and diet and ended up on insulin. Conversely, other family members, who were known to be very non-compliant, were never prescribed insulin. Although the positive aspects of insulin were noted, the patients talked more about the negative aspects and stated that being on insulin represented failure in disease management. Insulin use was reported to be associated with the onset of complications. Forty-three percent stated they believed that the initiation of insulin led to the development of serious complications; 25% acknowledged a fear that insulin causes blindness. Representative statements included, "People have told me: don't take insulin. You're going to go blind like my grandmother, or my father, or my brother." Most patients at some point in the interview quoted advice and stories they had heard from friends, neighbors, and relatives. In particular, the patient's views about insulin therapy were heavily influenced by perceived compliance and complication development in family members who had taken insulin. However, these data were qualitative in nature and call for a more objective, quantitative approach to examining the influence of the family on patients with diabetes, especially within ethnic minority groups.

Wing, Epstein, Nowalk, Scott, and Gooding (1987) examined family history and its effect on treatment outcome in Type 2 diabetes. There were 77 participants, with 49% having at least one first degree relative with diabetes. In this study, patients with and without a family history of diabetes did not differ in pre-intervention weight and diabetes control, nor did they differ in total weight loss in response to the intervention program. However, there were several limitations to this study. No information was provided regarding the ethnicity of the participants examined. This factor was also not considered in the analysis and interpretation of the data. In addition, this study focused on only one aspect of diabetes management, weight loss. The potential differential effect of perceived compliance and complications of family members was not considered. Conceivably, family history could either promote or discourage patient compliance based upon how family members have been perceived and the consequences they encountered.

In addition, the use of the health outcome of weight loss alone as the dependent variable is problematic. Patients were required to be compliant across multiple factors in order to achieve weight loss, including dietary changes, exercise, and attendance to booster sessions. However, no information was provided regarding patient compliance with these components of the intervention. Consequently, the relationship of family history to these specific health behaviors was not considered. Furthermore, a singular focus on weight loss negates examination of many other health behaviors required for good metabolic control including medication administration and blood glucose testing.

While the authors attempted to consider the role of family history, by simply classifying individuals as "yes" or "no" to family history, they failed to consider important information. Primarily, there was no attempt to assess how much the family member's behaviors or conditions would have impacted the participant. There was no attempt to examine interconnectedness or the degree of closeness between the participant and the identified family member.

Family History: A Multi-factorial Variable

The Hunt, Valenzuela, and Pugh (1997) study included a sample of ethnic minorities and suggested that family history is a very influential factor on both patient health beliefs and health behavior. On the other hand, the Wing et al. (1987) study focusing on weight loss intervention revealed no apparent effects of family history. What can account for such equivocal findings?

The impact of family history is likely to be multi-factorial and to vary across individuals. Depending upon the specifics of the family history (were there significant medical complications, is there a history of compliance or noncompliance) an individual could respond in a number of ways. For example, the individual whose diabetic mother was highly non-compliant but never experienced any significant complications may have a very different approach to diabetes management than the individual whose diabetic mother was extremely compliant and yet suffered through numerous complications. Clearly, a detailed examination of the ways in which family history may affect patient health behaviors is needed.

CHAPTER 2
PURPOSE AND HYPOTHESE

Purpose

Currently a gap in knowledge exists concerning the impact of family history on a patient's health behavior. The main objective of this study is to begin to bridge that gap by examining how family history influences a patient's health behavior. The study's focus is on youths with diabetes, as the link between family and patient behavior may be particularly strong in children and adolescents. While many adults already have significant complications when first diagnosed with diabetes, fewer youths have pre-existing complications at the time of diagnosis. Understanding the links between patients' beliefs and attitudes about family members' diabetes care has important implications for intervention efforts designed to delay or prevent diabetes-related complications in youths. Further, few studies have made direct comparisons of youths with Type 1 and Type 2 diabetes. In this study, the similarities and differences in health beliefs and health behavior between these populations were examined.

Many authors acknowledge that a major limitation within the existing literature is a lack of inclusion of minority populations. Although chronic disease disproportionately affects many ethnic groups, the majority of studies fall far short of providing useful information for ethnically diverse populations. The samples reported in most studies have been non-representative, with most samples over 90% Caucasian American. In order to increase the ecological validity of data in this area, studies focusing on or including representative proportions of minority participants need to be conducted. It is likely that more minority patients will have a close family member with diabetes by virtue of the generally higher prevalence of diabetes in minority groups. In addition, the impact of family history may differ across ethnic groups as cultures place varying values or importance on contact with extended family members. In addition, health beliefs and behaviors may vary across culture.

Another shortcoming within the existing literature is the tendency to examine only one aspect of the prescribed medical regimens, whether it is weight loss or medication taking. However, management of most chronic diseases requires a plethora of health behaviors that the patient must perform regularly. Failure to consider all disease management behaviors results in an incomplete picture. In this study, the full range of diabetes management behaviors was examined with the utilization of two models, one general in nature and the other behavior-specific.

Family history has persistently been type-cast as a demographic variable in research, limiting its potential usefulness as an explanatory variable. This study attempted to collect a rich data set to better elucidate the role of family variables in an ethnically diverse sample of patients with diabetes.

Hypotheses

We anticipated differences based upon type of diabetes and race, with Type 2 patients and African Americans engaging in less desirable health behaviors than Type 1 patients and Caucasian Americans. Patient perceptions of a diabetic family member's health behavior and complication status were expected to be related to the patient's own diabetes management behavior. However, we hypothesized that interconnectedness and patient health beliefs would both assume moderating roles; the link between patient and family member behavior would be greatest in cases of high interconnectedness and for patients whose health beliefs linked health behavior to health status.

CHAPTER 3
METHODS

Participants

Participants were recruited from the Pediatric Endocrinology Clinic at the University of Florida's Shands Teaching Hospital and the Vanderbilt University Medical Center. All youths with diabetes presenting to the diabetes clinic who were between the ages of 12 and 21 years of age and had a positive family history of diabetes were eligible. Participants were also required to have had diabetes for at least one year duration and to have a telephone in the home.

In order to facilitate analysis and hypothesis testing, minority patients, patients with Type 2 diabetes, and patients who have lived with a relative who has diabetes were over-sampled. Originally, a goal of a total sample size of at least 100 participants was set. Of those, 40% were to be African American, 40% were to have Type 2 diabetes, and 40% were to have lived with a family member with diabetes. This arbitrary over-sampling was an attempt to secure sufficient numbers for comparisons.

Recruitment

A member of the study team approached participants individually when they presented for routine diabetes-related physician visits. At that time, the rationale for the study was presented, and informed consent was obtained. For youths under the age of 18 years, the informed consent procedure included both parental informed consent and child assent.

Procedure

After informed consent/assent was obtained, the research representative asked the participant to complete a demographic questionnaire (Appendix A). All demographic questionnaires were completed during this initial patient contact, occurring at the routine doctor visit. The demographic questionnaires included the following information: youth's current age, gender, race, age at diagnosis, type of diabetes, symptoms at disease onset, initial treatment approach, weight at birth, length at birth, and birth order. School lunch status (free, reduced, full price) was also reported and used as an indication of socioeconomic status (SES). According to the USDA's Child Nutrition Programs-Income Eligibility Guidelines, the maximum income for a family of four qualifying for Free Lunch Status is $22,945/year, and $32,653/year for Reduced Lunch Status. Participants who were not currently in school were asked if they ever received free or reduced lunch during high school. The demographic questionnaire asked the participants to list all family members who had diabetes at the time or any point in the past. A chart review was conducted in order to obtain the most recent Hemoglobin A1c value for each patient. This information was recorded for descriptive purposes. Hemoglobin A1c is a routine laboratory test used to infer mean level of metabolic control over the proceeding 2 –3 months.

Structured 24-hour recalls (two during the weekday, and one during the weekend) were conducted over the course of a two-week period in order to obtain information concerning health behaviors (Appendix B). Two weekdays and one weekend day were selected in order to obtain a realistic and reliable indicator of health behaviors as activities on weekdays versus weekends may vary. In addition, multiple assessments provide a more reliable estimate of health behaviors, as a one-time assessment may occur on an atypical day and would therefore be poorly representative of typical health behaviors.

The adolescents served as the only source of information throughout this study. They completed the 24 hr recall interviews, provided their perceptions about the health behaviors and health status of their relatives, and described their own health behavior and health beliefs. Because this age group often acts with decreased parental supervision, parents have been shown to add little information beyond that which the adolescent was able to give. Consequently, data were only obtained from the participating youths.

During the initial telephone contact each subject completed a brief structured interview (Appendix B). The structured interview focused on the participant's perceptions of his/her family member's health behaviors and health status. If the patient had lived with only one relative with diabetes, the interview was completed with that relative in mind. However, if the patient had lived with several relatives with diabetes, the patient was asked to indicate which relative he/she spent the most time with (ate meals, did activities). The subsequent interview was then completed with that relative in mind. If the patient had not lived with any relatives, the interview was completed for the relative that they spent the most time with in mind. Additionally, participants were asked to answer several brief questions related to their own health beliefs. Following the structured interview, the first of three 24-hour recall interviews was then completed.

After this first telephone contact, the participants were contacted on two more occasions to complete the remaining 24-hour recall interviews.

CHAPTER 4
DESCRIPTION OF VARIABLES

Outcome Variables

The primary outcome variables were the patient's diabetes-related health behaviors. They were obtained by the patient's reports of his/her own behaviors via the 24-hour recalls. The data across the three 24-hour recalls was used to estimate diabetes-related health behavior over four domains: medication taking, diet, exercise, and blood glucose testing.

Medication

In considering medication, medication skipping and the percentage of prescribed medications taken were observed. First, the prevalence of medication skipping for each subject was estimated. At the beginning of each interview, participants self-identified how often they were to take medication for diabetes management. The total number of times they reported taking medication during each of the 24-hour recall interviews was counted. If the reported frequency of medication taking was less than the prescribed frequency of medication taking for any of the three interviews, the subject was coded as a "medication skipper." Those who reported not missing any medication were coded as "0" skips and those who acknowledged missing medication were coded as "1."

Next, the percentage of prescribed medications taken was calculated. If participants met or exceeded the prescribed frequency of medication taking, they were assigned a score of 100% for the day. Otherwise, the percentage of prescribed medications taken was calculated: (actual frequency of medications / prescribed frequency of medications) x 100. An overall score for medication taking was calculated by averaging the percentage of prescribed medications taken across the three interviews.

Diet

Several elements were considered in examining the diet of participants. In addition to counting the 1) actual frequency of meals, each food or drink item consumed was broken down into 2) total calories, 3) percent of calories from fat, 4) percent of calories from carbohydrates and 5) grams of concentrated sugar using the US Department of Agriculture Database (USDA, 2002). A daily total and then mean across the three interviews was then calculated for these categories (Table 3-6).

Exercise

For each physical activity reported during the 24-Hour Recall, the associated number of Kilocalories (Kcals) per minute was determined using Katch and McArdle's Occupation and Exercise Coding (1977). The total energy expenditure was then calculated by multiplying the estimated Kcals/minute by the actual number of minutes the participant reported exercising. This was calculated for each activity and then summed to determine a daily total for energy expenditure.

Blood Glucose Monitoring

Lastly, blood glucose monitoring was examined by counting the simple frequency that the behavior occurred each day and then averaged across the three days.

Predictor Variables

Predictor variables fell into one of five categories: Demographic, Disease, Family, Relative's Characteristics or Health Beliefs. The specific variables comprising each category are listed below along with an explanation of how they were calculated and the treatment of missing data.

Demographic Variables

Demographic variables included 1) Ethnicity, 2) Campus of Recruitment, 3) Gender, 4) Age, 5) SES (as indicated by free or reduced lunch status) and 6) Participant's Height.

Ethnicity. At the time of enrollment, participants were asked to classify themselves as Caucasian American/White, African American/Black, or Hispanic or Other. As all participants either classified themselves as Caucasian American or African American, ethnicity became a dichotomous variable, with Caucasian Americans coded as "1" and African Americans coded as "0."

Campus of recruitment. As all participants were recruited from one of two campuses, campus of recruitment became a dichotomous variable, with University of Florida coded as "1" and Vanderbilt University coded as "0."

Age. At the time of enrollment, all participants provided their date of birth. Age in years was calculated as a continuous variable by subtracting the date of birth from the date of the first interview.

Gender. Participants classified themselves as either male or female, generating a dichotomous variable, with male coded as "1" and female coded as "0."

SES. A crude estimate of socioeconomic status was determined by having the participant's classify their school lunch status currently or for their last year in school. As this variable was non-normally distributed, it was dichotomized into regularly priced or free/reduced priced lunch status, with regularly priced coded as "1" and free/reduced priced coded as "0."

Height. Participants reported their current height on the Demographic Questionnaire. These values were uniformly converted to total inches in height.

Disease Variables

Disease variables included the terms of interest that were focused on the participant's diabetes. These included the participants 1) Type of Diabetes and 2) Disease Duration.

Type of diabetes. At the time of enrollment, participants were asked to identify their type of diabetes, which was confirmed by medical record review. As all participants could be classified as having Type 1 or Type 2 diabetes, diabetes type became a dichotomous variable, with Type 1 coded as "1" and Type 2 coded as "0".

Disease Duration. Participants provided their age at diagnosis. This was subtracted from their current age to determine the length of time the participant had been diagnosed with diabetes.

Family Variables

Family Variables were all terms of interest and were specifically related to information about the family members themselves or the participant's knowledge/impression of the family member. These variables included 1) Number of Family Members, 2) Same Type of Diabetes, 3) Relative's Complication Status (RCS), 4)

Relative's Health Behavior (RHB), 5) Interconnectedness (Overall and Domain-Specific), and 6) Perceived Adequacy of the RHB.

Number of family members. At the time of enrollment, participants were asked to list all their family members who had a history of diabetes. At the time of the first telephone interview, this list was reviewed with each participant to ensure that it was comprehensive and no one had been omitted to the participant's knowledge. The total number of family members with diabetes was summed for each participant.

Same Type of Diabetes. If the participant reported having the same type of diabetes as the one family member about whom they selected to complete the structured Family History Interview, they received a "1" for this variable. Indication of having a different type of diabetes was coding as a "0." Also, if the participant did not know what type of diabetes their selected family member had, they were coded as a "0."

Relative's Complication Status (RCS). RCS is an indication of diabetic health complications experienced by the selected family member. Initially, a frequency score was derived by summing the number of health problems identified as being the result of diabetes from the Structured Family Interview. There are six potential areas of diabetes complications addressed within the interview (vision, hypertension, stroke, heart attack, kidney disease/failure, and lower extremity arterial disease). Using these areas, a potential RCS score of 0 – 6 was created. However, diabetes-related death was also considered under complication status, and automatically received the highest weighted score of "7." Therefore, if a family member was identified as having hypertension and kidney failure, for example, a score of "2" would be given. However, if this resulted in death, a score of "7" would be assigned.

During the interview, if participants answered "Don't Know" the item was scored as "0" and included as such in all subsequent analyses involving this variable. The alpha coefficient for this scale was 0.5. Based on these scoring criteria, the RCS was generated and found to be non-normally distributed. As a result, the variable was re-coded, where "0" = no diabetic complications and "1" = any diabetic complications.

Relative Characteristics

Variables included under this section were specifically focused on relating to the selected family member, either through describing the family member's health behaviors or indicating how much the participant knew about the selected family member. These variables included Relative's Health Behaviors (RHB), Perceived Adequacy of RHB, and Interconnectedness.

Relative's Health Behavior. Relatives' Health Behavior (RHB) was estimated from the Structured Family Interview and determined for each domain of the diabetes regimen. This included what the subject believed about their relative's medication taking, blood glucose monitoring, diet, and exercise.

RHB (Medication). Medication taking was operationalized by identifying relatives as skipping or not skipping their medication, based on the interview information provided by the participant. The relative's medication taking behavior was determined from Section C of the Family History Interview (Appendix B). If participants reported that the selected family member took 100% of their prescribed medication, the family member was identified as "compliant" and coded as "1." All other responses were coded as "0" for medication compliant, which included "Don't Know" responses.

RHB (Blood glucose monitoring). Blood glucose monitoring was examined in terms of the frequency of daily testing. The selected family member's blood glucose monitoring behavior was determined from Section F of the Family History Interview (Appendix B). If participants reported that the selected family member tested their blood glucose 100% of the time prescribed, they were identified as "BG compliant" and assigned a score of 1; all others (including "Don't Knows") were assigned a score of 0.

RHB (Exercise). The selected family member's exercise classification was determined from Section D of the Family History Interview (Appendix B). Relatives were identified as "exercisers" or "non-exercisers," based on whether they were believed to participate in any exercise. Those who were "exercisers" received a score of "1," while "non-exercisers" received a score of "0."

RHB (Diet). The selected family member's diet behavior was determined from Section E of the Family History Interview (Appendix B). Participants provided information about how often they believed their relatives ate fried foods and sweets/concentrated sugars. In observing the frequency of eating fried foods and sweets, an arbitrary cutoff was established in order to categorize the selected family members' as "healthy dieters" versus "unhealthy dieters." Examination of the distribution revealed that the cutoff for healthy dieting was eating fried foods and/or sweets no more then three times per week. "Don't Know" responses were included in the "diet unhealthy" group.

Perceived Adequacy of RHB. Perceived adequacy of the relative's diabetes-related health behavior was also examined. This was assessed by having the participants rate the appropriateness of their family member's health behaviors. For example, "**Given that your family member has diabetes, would you say that he/she exercises "too much," "too little" or "about the right amount"?** (Appendix B Items C6, D6, E2, E4, F4 and G4). Initially, "too little" received a score "1," "about the right amount" received a score of “2” and “too much” received a score of “3.” However, since the data was non-normal in distribution, perceived adequacy was re-coded as “about right” (scored 1) versus “all other responses” (scored 0). “Don’t Know” responses were absorbed into the “all other response” category and thereby received a score of “0.”

Interconnectedness

Overall Interconnectedness (IC). Interconnectedness was a measure of the degree of closeness between the relative and the participant. This was operationalized by how much information the participant possessed about the family member’s health behaviors and health status. During the structured interview there were a total 43 items regarding the relative’s health behavior (RHB) and the relative’s complication status (RCS) on which all subjects provided information about their family member. If the participant reported “Don’t Know” they were given a score of “0” for that item. Otherwise a “1” was assigned to represent having some knowledge about the relative. The proportion of interview items that the participant was able to provide information about the relative was calculated. This percentage was used to represent overall interconnectedness.

Interconnectedness for RCS was calculated from 23 questions about the relative's health status that all participants were asked. The α coefficient for this variable was 0.9. Also, Interconnectedness for the relative’s health behavior (RHB) was calculated from 20 questions that all participants were asked about their relative’s medication taking, blood glucose testing, diet, exercise, and attendance to routine diabetes check-ups. The alpha coefficient for this variable was 0.9. There was a high correlation between the interconnectedness score for RCS and interconnectedness for RHB ($r = 0.7$, $p < .01$).

Consequently, all 43 items were combined to form an overall interconnectedness score, α =0.9, which was entered into the General Model.

Domain Specific Interconnectedness. The definition and methods for calculating Overall Interconnectedness were described above. The RHB questions that were included in calculating Overall Interconnectedness represented the four behavior areas. A behavior-specific interconnectedness score was developed for each domain of the diabetes regimen. Four questions were asked of all participants regarding their relative's medication taking, blood glucose testing, exercise, and diet. From these questions, a domain specific interconnectedness score was calculated, ranging from "0" – "4" for each domain. Alpha coefficients were as follows: Medication Taking α=0.8, Blood Glucose testing α=0.8, Exercise α=0.9, and Diet α=0.9. In the Domain-Specific model, degree of interconnectedness was entered for the related behavior being examined. For example, when Model 2 attempted to predict the child's medication compliance, the degree of interconnectedness for medication taking (i.e. how much the child knew about their relative's medication taking) was entered into the model.

Health Beliefs

The category of health beliefs variables focused on what the participant believed affected health status. This was assessed generally and for specific behaviors. Variables included in this category were General Health Beliefs (GHB) and domain-specific health beliefs.

General Health Beliefs (GHB). General health beliefs were assessed by questioning how strongly the participant linked health status to health behavior in patients with diabetes (Appendix B, Items M1 – M4). For example, participants were asked "**Do**

you think that people with diabetes can delay or stop complications from happening to them by doing what their diabetes doctor tells them to do?" General Health Beliefs were assessed by first asking the participant how important they think a person's behavior is in preventing or delaying the onset of diabetes-related complications. They then indicated whether they believe that people in general, their selected family member, and themselves can delay or prevent diabetic complications. Initially, responses were scored in rank order with "0" indicating not important/cannot affect complications to "3" indicating very important/can definitely affect complications. No subject answered "Don't Know" to more than one question about general health beliefs. Also, "Don't Know" responses tended to be sporadic in nature. Given this, "Don't Know" and missing values were replaced with the participant's mean score across the other general health beliefs items. However, the item distribution was non-normal. Given this, each item was re-scored, where 1 = "very important/definitely" and 0 = all other responses. The items were then summed, producing a potential range of "0" – "4" in General Health Beliefs; this score was normally distributed.

Domain Specific Health Beliefs. Domain-specific health beliefs were assessed by asking participants to rank the importance of each domain of the diabetes regimen. The following coding scheme was employed for the ranking of each domain: "0"=not important, "1"=fairly important and "2"=very important. The reader may refer to items N1- N4 of the Family History Interview to view the specific questions (Appendix B).

Only 1 child offered a "Don't Know" in response to these questions, which was coded as "0" and included as such in subsequent analyses of this variable.

Given the non-normal distribution, responses were re-coded as “very important”=1 and “all other responses” = 0.

CHAPTER 5
DATA ANALYSIS

All interviews with patients were recorded. Subsequently, 25 interviews were randomly selected for review. All 25 reviews included a 24-hour recall interview. Additionally, 10 of the 25 reviews were the first interview conducted, and thereby included the Structured Family Interview as well. An independent assessor listened to and coded the 25 interviews. Percent agreement between the original and independent assessor was calculated to determine reliability in coding of those 25 interviews. Inter-rater reliability was determined to be adequate, with an average percent agreement of 92.4%.

Using data obtained from the structured interview, coefficient alphas were calculated for variables comprised of multiple interview items: Overall Interconnectedness, Relative's Complication Status (RCS), and General Health Beliefs. The respective coefficient alphas and explanations of the treatment of missing data are included in each respective Description of Variables Section.

Descriptive statistics were conducted comparing participants based upon type of diabetes, ethnicity, and campus of recruitment on all study measures. Chi Square analyses were used to assess differences among categorical variables. In an effort to allow for the greatest sensitivity in detecting potentially confounding variables between the groups, p-levels were maintained at .05 during t-tests for all continuous variables.

Hierarchical multiple regression analysis was conducted to determine which study variables significantly predicted patient diabetes-related health behavior. Linear regression was employed for continuous outcome variables, while logistic regression was used for dichotomous outcome variables. Variables were entered in conceptually-related blocks (e.g. demographic variables, disease variables) depicted in Figure 1. Nonsignificant ($p > .10$) variables were deleted before the next block of variables was entered. However, variables of primary interest – ethnicity and type of diabetes – were retained and only excluded from the final model if they remained nonsignificant. Since gender and height have traditionally been considered predictors of diet behavior, they were maintained in all models with dietary outcome variables and excluded from the final model if they failed to reach significance. The order of entry for both models was: 1) Demographic Variables, 2) Disease Variables, 3) Family Variables, 4) Relative Characteristics, 5) Health Beliefs, and 6) relevant Two Way Interactions.

One general model and one specific model were tested (Figure 1). Model 1, the General Model, examined the adolescent's overall interconnectedness with the relative and the adolescent's general health beliefs as predictor variables. In contrast, Model 2, the Domain-Specific Model, examined how much the adolescent knew about a relative's specific health behavior (e.g., Interconnectedness for Exercise), the adolescent's perceptions of the relative's precise health behavior (e.g., how much a relative exercised-RHB), the adolescent's evaluation of this behavior as adequate or inadequate (e.g. was that amount of exercise was too much, too little, or about the right amount) and the adolescent's health beliefs about that specific behavior (e.g., how important is exercise in delaying or preventing complications) as predictors of the adolescent's own health behavior (e.g., exercise).

Both the General and Domain Specific models attempted to predict to the same outcome variables (Medication Skipping, Blood Glucose Monitoring, Exercise, Total Calories, Percent of Calories from Fat, Percent of Calories from Carbohydrates, Grams of Concentrated Sugar consumed, and Frequency of Meals). The same demographic, disease, and general family variables were considered in each model (Figure 1.0). The only difference between the two models was that certain predictor variables (Relative Characteristics and Health Beliefs) were either general or domain-specific. In addition, the Domain Specific model included the participant's perception of the relative's behavior and its adequacy. For example, "Given that your relative has diabetes, do you think that he/she exercises too much, not enough or about the right amount."

VARIABLES	MODEL 1	MODEL 2
	(General)	**(Domain Specific)**
Demographics	Age, Gender, SES, Race, Campus of Recruitment (Height for Dietary Variables Only)	Age, Gender, SES, Race, Campus of Recruitment, (Height for Dietary Variables Only)
Disease Descriptives	Type of Diabetes, Disease Duration	Type of Diabetes, Disease Duration
Family Variables	Relative's Complication Status, Same Type of Diabetes, Total # Relatives with Diabetes	Relative's Complication Status, Same Type of Diabetes, Total # Relatives with Diabetes
Relative Characteristics	Overall Interconnectedness	Domain-Specific Interconnectedness, Relative Specific Health Behavior Perceived Adequacy of Behavior
Health Beliefs	General Health Beliefs	Domain-Specific Health Beliefs
Outcome	Medication Taking, Blood Glucose Monitoring, Exercise, Diet (Total Calories, Frequency of Meals, Concentrated Sugar, % From Fat % from Carbohydrates	Medication Taking, Blood Glucose Monitoring, Exercise, Diet (Total Calories, Frequency of Meals, Concentrated Sugar, % From Fat % from Carbohydrates

Figure 1. Model Overview

CHAPTER 6
RESULTS

Attrition

Of the total 126 potential participants approached, 14 (11.1%) refused enrollment in the study. The majority of these youths (11 of 14) were from the Florida campus, were Caucasian American (10), were male (9), and had Type 1 diabetes (9).

Informed consent and demographic information was obtained on the 112 participants who enrolled in the study. However, data from 22 of those enrolled were unavailable or insufficient for data analysis. Six recruits were never successfully reached with the contact information provided. Two participants withdrew from the study, reporting lack of interest; one was withdrawn by her parents secondary to illness. Due to excessive lapse of time between 24-hour recalls, data from two participants were unacceptable. Additionally, the interviewer was unable to complete all three interviews with 11 recruits for various reasons (disconnected telephone, no answer, subject was not available). There were no significant differences in demographic variables between the 90 participants who completed the study and the 22 participants who did not complete the study (Table 1).

Sample Characteristics

Participants

The majority of the 90 participants were female (61.1%), Caucasian American (63.3%) and came from the Vanderbilt campus (70%) (Table 2). They ranged in age from 12 to 20 years, with a mean age of 15 years. One in four (25.5%) participants classified themselves as receiving school lunch at a free or reduced price. Fifty-nine had Type 1 diabetes and 31 had Type 2 diabetes (Table 2). The majority (88.9%) of all the participants was initially treated with insulin and reported initial symptoms of increased urination (86.7%), increased thirst (92.2%), and fatigue (76.7%). However, only 33.6% reported ketoacidosis at the time of disease onset. The sample's mean HA1C was 8.9.

Participants' Family Members with Diabetes

As stipulated by the study protocol, all participants had at least one family member with diabetes. In fact, most (74%) had multiple family members with diabetes and averaged 2.7 family members (Table 3). The majority of the family members (58.9%) were reported to have Type 2 diabetes. Participants could not identify the type of diabetes for 10% of family members. Participants tended to choose grandparents (38.9%) or a first-degree relative (31%) as the selected family member about whom to answer the health behavior and complication status questions. Thirty-nine percent of the participants were currently living with the selected family member, while an additional 9% had lived with the family member in the past; 45.5% chose a relative whose type of diabetes matched their own (Table 3).

Sample Characteristics by Disease Type, Ethnicity, and Campus

Females constituted the majority of both the Type 1 and Type 2 samples, at 55.9% and 71%, respectively (Table 4). Type 2 participants were more likely to be receiving free or reduced lunch (38.7%) compared to Type 1 participants (18.7%) ($X^2 = 4.7$, p=.03). Also as expected, the Type 2 youths tended to be older when first diagnosed, averaging 12-years-old as opposed to Type 1 participants who were typically 8 years old at disease onset (t= 5.5, p<.001) (Table 4). Consequently, those with Type 1 diabetes demonstrated a longer mean disease duration of approximately 7 years, twice that of Type 2 youths (t=-6.0, p<.001). As predicted, Type 2 youths demonstrated a higher weight to height ratio, with a mean current body mass index (BMI) at 35.7 kg/m2, compared to the 22.8 kg/m2 average by their Type 1 counterparts (t = -10.7, p<.001). There were no significant differences in birth weight among the groups, but those with Type 2 diabetes had significantly greater birth length (Table 4).

At the time of this study, 15% of Type 1 participants had insulin pumps installed. Overall, Type 1 patients were prescribed an average of three insulin injections per day. Fifty-eight percent of Type 2 participants were being treated with insulin injections alone, 16% took oral hypoglycemics alone, 19.3% used some combination of insulin injections and oral hypoglycemics, while 6.4% used dietary considerations and weight management as their sole means of metabolic management (Table 4). There were no significant differences in current metabolic control, with HA1Cs at 8.9 and 9.1 for Type 1 and Type 2 youths, respectively (Table 4)

All of Type 1 youths were initially treated with insulin injections, compared to 71% of the Type 2 adolescents (X^2= 17.0, p=.001). No significant between group differences were demonstrated in the occurrence of fatigue, increased thirst, increased urination, or ketoacidosis at the onset of disease (Table 4).

As expected, most Type 1 participants were Caucasian American (78%), and most Type 2 participants (64.5%) were African American (X^2= 15.8, p<.001) (Table 4). African American youths (45.5%) were more likely to be receiving free/reduced lunch compared to Caucasian American participants (14%) (X^2=11.5, p=.001). Additionally, African American participants generally demonstrated a higher BMI (30.9 kg/m2) than their Caucasian American counterparts (25.0 kg/m2) (t =3.1, p=.003) (Table 4). However, both groups shared similar HA1C values at, 9.1 and 8.9, respectively.

While >80% of the Caucasian American participants came from the Vanderbilt campus (X^2 = 8.5, p=.004), the African-American participants were more evenly distributed across campus (16 from UF and 17 from Vanderbilt) (Appendix C). Participants from Florida were more likely to be receiving free/reduced lunch compared to those from Vanderbilt (X^2 = 4.5, p=.034) (Appendix C).

Participants' Health Behaviors by 24-Hour Recall

Information about the participants' health behaviors was gathered from the three 24-hour recalls that each subject completed. The interviews were examined for specific data regarding each domain of health behavior including the participant's medication taking, monitoring of blood glucose, diet, and exercise. The following information describes the participants' data for each area of interest.

Medication Skipping. While the majority of the participants indicated no medication skipping over the three interviews, 40.9% of the participants were determined to have skipped medication at least once. There were no significant differences in the prevalence of medication skipping across disease type or ethnicity (Table 5).

Participants tended to indicate high compliance, generally reporting better than 90% compliance with taking medication the prescribed number of times (Table 5). There were no significant main effects or interactions based upon disease type or ethnicity.

Blood glucose monitoring. Type 1 participants monitored their blood glucose levels more frequently, averaging 3.31 tests per day compared to the 2.07 tests per day completed by Type 2 youths (t= 28.4, p<. 001) (Table 5). For the overall sample, Caucasian American participants tested more frequently than their African American counterparts, reporting 3.09 and 2.52 tests per day, respectively (t= -2.1, p=.041). However, an examination of blood glucose testing within each type of diabetes, revealed no significant differences between Caucasian American and African Americans. However, there were no main effects or interactions among any groups in metabolic control during the study, as mean blood glucose levels reported from blood glucose testing ranged from 154 and 165 for both types and ethnicity groups (Table 5).

Diet. In considering the participant's disease type, there were no significant differences in total calories consumed or percent of calories from fat (Table 6). However, Type 2 adolescents consumed considerably more grams of concentrated sugar than Type 1 participants, 18.9 grams and 12.5 grams per day respectively (t= 12.1, p=. 001). Even though both groups were similar in total number of calories consumed, the data suggest that Type 2 youths were more likely to consume three larger meals, as opposed to more distributed eating with snacking as recommended. Type 2 youths averaged 2.98 meals per day compared to the 3.47 meals per day eaten by Type 1 youths (t= 12.2, p=. 001)

(Table 6). There were no significant discrepancies in diet based on ethnicity. Likewise, there was no ethnicity by type of diabetes interaction for the participants' diet.

Exercise. Fifteen participants reported no exercise over the three days assessed. Of those who exercised, frequency, intensity and duration were all considered. Overall, both Type 1 and Type 2 participants reported engaging in approximately one hour of physical activity per day over the three days assessed (Table 6). There were no significant main effects or interactions in exercise frequency, duration, or energy expenditure based on ethnicity or disease type (88.97% vs. 74.8%).

Participants' type of diabetes compared to the selected relative

When considering which participants had the same type of diabetes as their selected family, the data reveals that of the 90 participants to complete the study, 41 (45.5%) had the same type of diabetes as the relative. A greater proportion of the Type 2 participants (67.7%) had the same type of diabetes as the selected relative than Type 1 participants (33.9%) ($X^2 = 9.4$, p=.002). African American and Caucasian American participants were just as likely to have the same type of diabetes as the selected family member.

Participants' degree of Overall Interconnectedness (IC)

The degree of closeness or how much the participant knew about their family member's health status and health behavior varied considerably. Interconnectedness scores ranged from 0 to 100%, as some participants could not provide any information about their relative and other participants had an answer for every question. Overall, participants were able to offer answers to 81% of the questions posed to them about their relatives (Table 7). There were no significant differences in mean degree of general interconnectedness across the groups based on disease type or ethnicity. However, when the participant and relative shared the same type of diabetes, the participants tended to know more about their relative's health behavior and complication status, with Overall Interconnectedness score.

Participant's degree domain specific interconnectedness

Overall, participants answered the most questions about their relative's exercise behavior (85% of questions) and the least about their medication taking (76% of questions) (Table 7). Among the various domains of interconnectedness, there were no significant main effects based on type of diabetes or ethnicity. However, there was a significant ethnicity by disease type interaction for knowledge about the relative's exercise behavior (F= 5.9, p=.02). Additionally, those who shared the same type of diabetes tended to know more about their relative's behavior. For blood glucose testing interconnectedness was 86.6% for those with the same type compared to 71.4% for those with different type of diabetes (t = -2.2, p=.03). For medication taking those with the same type of diabetes demonstrated 85.98% Interconnectedness compared to 67.86% for their counterparts (t = -2.8, p=.007).

Participants' General Health Beliefs (GHB)

Table 9 displays the health beliefs of the participants, which were fairly uniform across disease type and ethnicity. There was an overall mean of 2.2 (Table 8). Those with Type 1 and Type 2 diabetes were similar in their perspectives about the importance of patient behavior in affecting the development of complications. When asked more specifically, there were also no differences across type of disease in beliefs about the connection between health behavior and health status for people with diabetes in general, the participants' relatives or the participants themselves (Tables 8). Ethnicity did not significantly affect these beliefs. Likewise, there was no significant interaction between ethnicity and disease type.

Participants' domain specific health beliefs

In categorizing health behavior as "very," "fairly," or "not" important in delaying/preventing complications, participants presented an almost unwavering belief that medication compliance, blood glucose monitoring, and diet are "very important" in delaying or preventing complications, as this was endorsed by 98%, 90%, and 88% of participants, respectively (Table 9). Again, there were no significant differences based on type of diabetes in these views about medication taking, blood glucose testing, and diet. Type 1 and Type 2 participants were also uniform in their belief that exercise plays a considerably less important role in the prevention of morbidity, as just less than half reported that exercise is only "fairly" important. Ethnicity did not significantly affect these health beliefs; there were no significant interactions between ethnicity and type of diabetes.

Relative's Complication Status (RCS)

The overall mean RCS for the sample was 0.5. There was no main effect for type of diabetes and no significant interaction between ethnicity and disease type (Table 10). However, there was a main effect for ethnicity. African American participants reported a greater family incidence of complications than Caucasian American participants, with RCS scores of 0.9 and 0.3, respectively (t=2.4, p=.02). More specifically, family morbidity was more severe among African American family members, as they accounted for 72.7% (8 of the 11) of those with two or more diabetes-related complications. Of the 26 family members known to have been hospitalized secondary to diabetic complications, 88% had experienced only one admission (range = 1 – 7 diabetes related hospitalizations). Reasons for hospitalization are listed in Table 10. Considering all of the 249 family members, diabetes was identified as the primary cause of death in 8 family members. However, only one of the "selected" family members was identified as dying from diabetes related complications.

Considering microvascular complications, 63% of the selected family members were reported to have some problems with their vision; 19.3% of these problems were attributed to diabetes (Table 11). More specifically, 9 family members had undergone some type of eye surgery, 33% of which were attributed to diabetes. Four of the nine said they did not know if there was a connection between the eye surgery and diabetes. Five were blind, but diabetes was identified as responsible for the blindness in only 2 of the 5 cases, with one participant saying he/she did not know if there was a connection. Five relatives had been on dialysis at some point, four of which were attributed to diabetes (Table 11).

Considering macrovascular complications, of the 26 selected family members who had hypertension, only 3 were identified as related to diabetes (Table 12). The majority of participants (65%) did not know if their relative's hypertension was related to diabetes. Four family members had a history of heart attacks and seven had experienced a stroke; only one of which was identified as related to their diabetes. Mostly, the participants were fairly ambivalent about the cause of these macrovascular problems, as 40% related that they "did not know" if these complications were attributable to diabetes. Six relatives had undergone amputation of a lower extremity. Interestingly, there was no ambivalence here, as all of the amputations were said to be related to diabetes (Table 12).

Relative's Health Behavior (RHB)

Medication. Family members were generally prescribed to take medication for their diabetes about twice per day (Table 13). There were no significant differences across type of diabetes or ethnicity in frequency of prescribed medication. Nearly 44%

(38/90) of the selected family members were identified as compliant with medication taking. The rest, who were thought to skip their medications at least some of the time, were labeled as "medication non-compliant," and were entered as such in Model 2 for analysis. In comparing the occurrence of medication compliance and non-compliance among the relatives, there were no significant main effects or interaction for ethnicity and disease type.

Blood glucose monitoring. On average, family members were described as testing their blood glucose levels 2.4 times per day (Table 14). While there were no differences across type of disease, Caucasian American participants saw their relatives as prescribed to test their blood sugar more frequently (2.8/day) than African American participants (1.9/day) (F= 5.1, p=.03). Only 35.2% (31/90) were estimated to test their BG 100% of the prescribed time. In considering the occurrence of blood glucose testing noncompliance, there were no significant main effects due to ethnicity or disease type. There was also no significant interaction between these factors.

Exercise. For the entire sample, the mean hours of exercise per week was estimated to be about 1.4 hours (Table 15). Of note, more than half of the participants reported that their relatives engage in no regular exercise on a weekly basis. Of the 34 who identified their selected family members as exercisers, the relatives thought to spend approximately 3 hours per week doing so. In considering exercise compliance, there were no significant main effects for disease type or ethnicity; there was also no significant interaction between these factors.

Diet. The selected family member was typically reported to consume fried foods 3.7 times per week (Table 16). Type 1 participants thought that their family members consumed more fried foods (4.5 times per week) than Type 2 participants (2.3 times per week). There were no differences across ethnicity. Overall, family members were reported to eat sweets 4.3 times per week (Table 16). There were no significant discrepancies according to disease type or ethnicity. An examination of the distribution for this variable, revealed that only one-third of the sample consumed sweets and/or fried foods more than three times per week. By the specified criteria, 61% (55/90) of the selected family members were classified as "healthy dieters" as opposed to "unhealthy dieters. In considering diet compliance, there were no significant main effects for disease type or ethnicity; there was also no significant interaction between these factors.

Participants' Perceived Adequacy of RHB

Perceived adequacy was assessed via the participants ranking of their relative's health behavior as "too much", "not enough", or "about the right amount" given that they have diabetes. This was completed across all domains of health behavior including medication taking (Table 13), blood glucose monitoring (Table 14), exercise (Table 15) and diet (Table 16). Of those who provided a ranking, the majority of both Type 1 and Type 2 participants saw their relative's health behavior as adequate in medication taking (68.9%), blood glucose testing (56%), consumption of fried foods (56.7%), and consumption of sweets (52.2%). Only 30% of participants perceived their relative's exercise as adequate.

Models Tested

This study sought to examine the influence of family health behavior, family diabetic complications and participant's health beliefs on the participants' current health behavior. Given the number of predictor variables and the limiting sample size, two separate models were used to test these relationships (Figure 1.0).

One model was more general in nature, examining global factors such as the relative's overall health status and the participant's general health beliefs. However, the second model was more specific and focused on each domain of the diabetes regimen. In the Domain-Specific model, the family member's precise health behavior (e.g., exercise) was paired with the related and specific health belief (e.g., how important is exercise in delaying or preventing complications). Furthermore, domain specific interconnectedness (e.g., how much did the subject know about their family member's exercise behavior) was also considered. While different, both the general and specific models attempted to predict to the same outcome variables. Likewise, the same Demographic, Disease, and Family variables were considered in each model. Essentially, the only difference between the two models were the Relative Characteristic variables and Health Beliefs variables. A review of the models by their respective variables is provided below.

Outcome Variables for the General and Specific Models

The outcome variables were obtained from the 24 hr recall interview data and were used to test both the General and Domain-Specific models. Both models were tested for their ability to predict to the same outcome behaviors across the four domains of the diabetes regimen: 1) Medication Skipping, 2) Blood Glucose Monitoring, 3) Exercise and 4) Diet.

Medication Skipping. Subjects uniformly presented themselves as highly compliant with their medication taking, reporting taking greater than 90% of all diabetes medication prescribed. However, more variability was found in considering how many subjects skipped or did not skip any medication. Therefore, each model attempted to predict medication skippers from those who were completely compliant with their prescribed medication regimen.

Blood glucose testing. An average, daily frequency of testing over the three 24-hr interviews was calculated by dividing the total number of blood glucose tests reported across the interviews by three. This number was subsequently used as the Blood Glucose Testing outcome variable in both models.

Exercise. Like diet, there are several factors that are traditionally considered when examining physical activity. These include the frequency, intensity, and duration of the physical activity. These three factors were combined to produce a mean daily energy expenditure, which was predicted to in both models.

Diet. Diet is a complex factor to assess, as there are several important points that should be considered in determining if diet is healthy. Given this, the model attempted to predict total frequency of meals, total calories consumed, percent of calories from fat consumed per day, percent of calories from carbohydrates consumed per day and grams of concentrated sugar ingested per meal.

Demographic Variables for the General and Specific

The same demographic variables were entered into both the General Model and the Domain-Specific Model. The demographic variables included 1) Ethnicity, 2) Age 3) Campus of Recruitment, 4) Gender, and 6) SES, as determined by school lunch status.

Disease Variables for the General and Specific Models

The same disease variables were entered into both the General Model and the Domain-Specific Model. The disease variables included 1) Type of diabetes and 2) Disease Duration.

Family Descriptives

The same family descriptive variables were entered into both the General Model and the Domain-Specific Model: 1) Number of family members with diabetes; 2) Same Type of Diabetes as the selected family member (1 = yes; 0 = no); and 3) Relative's Complication Status (RCS) (diabetes complication: 1 = yes, 0 = no).

Relative Characteristics

The Relative Characteristic Variables varied, being general or specific, respective of the model being tested. For the General Model, the Relative Characteristic included Overall Interconnectedness (IC). "Interconnectedness" or the measure of the degree of closeness between the relative and the child, was used as a global factor. This was determined by assessing how much the participant knew about all of their relative's health behaviors and their relative's complication status (RCS).

The following Relative Characteristics were used in the Domain-Specific Model. 1) Domain Specific Interconnectedness (how much information the adolescent knew about their selected family member's health behavior); 2) Relative's Health Behavior (RHB) (the adolescent's perception of the relative's actual diabetes care behavior); and 3) Perceived Adequacy of RHB (the adolescent's perception of the adequacy of the relative's diabetes care behavior.

Health Beliefs

Model 1 considered the "General Health Beliefs" (GHB) of the subject. General Health Beliefs focused on whether the adolescent believed that there is an overall link between what a person with diabetes does and that person's health status.

Assessment of Domain-Specific Health Beliefs were used in Model 2, allowing for the examination of how important the participant thought each component of the diabetes regimen is in preventing or delaying the onset of diabetes-related complications. Participants were asked to rate medication taking, blood glucose testing, exercising, and diet on importance to health status.

In summary, the General Model or Model 1 used broad based, general factors for predictor variables. These predictors included overall Interconnectedness, and General Health Beliefs, along with the Relative's Complication Status (RCS). However, in the Domain-Specific Model, Model 2, the scope of each variable was narrowed to the behavior in question.

Model Results

Using the above specified variables, hierarchical multiple regression was used to analyze Model 1 and Model 2 for each separate outcome variable.

Medication Skipping

Both the General Model and the Domain-Specific Model failed to reach significance.

Blood Glucose Monitoring

In considering Blood Glucose Monitoring, the final General and Domain-Specific Models included only one demographic term (Campus of Recruitment) and one disease variables (Type of Diabetes), F (89)=18.1, $p<.001$, $R^2 = .293$, Adj. $R^2 = .277$, see Table 17. Adolescents with Type 1 diabetes tested considerably more often than those with Type 2 diabetes. Adolescents in Florida tested less than those at Vanderbilt. Family variables, relative characteristics and health beliefs all failed to predict frequency of blood glucose testing.

Exercise (Total Energy Expenditure)

Exercise (General Model). In considering exercise via reported total energy expenditure, the General Model successfully predicted to the outcome variable, F(89) = 4.1, p=.005, R^2= .160, Adj. R^2=.121; see Table 18. African American participants tended to report more exercise than their Caucasian American counterparts. There was an interaction between RCS and Same Type of Diabetes, which is depicted below in Figure 2. When the participant's relative did not have a complication, having the same type of diabetes had no impact on the adolescent's exercise. However, when the relative had complications, adolescents with a type of diabetes different from that of the relative, were more likely to exercise than adolescents with the same type of diabetes as their relative.

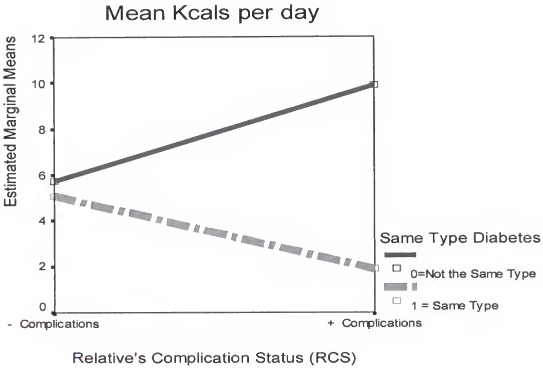

Figure 2. General Model Interaction for Exercise

Exercise (Domain-Specific Model). The Domain Specific Model was also significant, F(89) = 2.4, p=.02, $R^2 = .194$, Adj. $R^2 = .115$; see Table 19. African American participants demonstrated significantly more exercise than Caucasian American participants. Additionally, exercise was positively associated with having a type of diabetes different from that of the selected relative. Two interactions were significant: RCS*RHB, and Perceived Adequacy of RHB* Exercise Health Beliefs. The interaction between RCS and RHB is illustrated in Figure 3, while Figure 4 highlights the relationship between Perceived Adequacy of RHB and Exercise Health Beliefs.

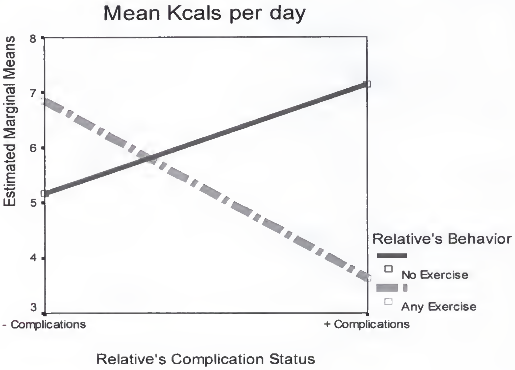

Figure 3. Domain-Specific Interaction A for Exercise

If the relative had no complications, the association between relative's exercise and adolescent's exercise was as expected, being positive related. However, in the case of relatives with a complication, adolescents who had relatives who engaged in no exercise were more likely to exercise than adolescents whose relatives exercised. It is as if having a relative with complications encouraged the adolescent to engage in behavior different from that of the relative.

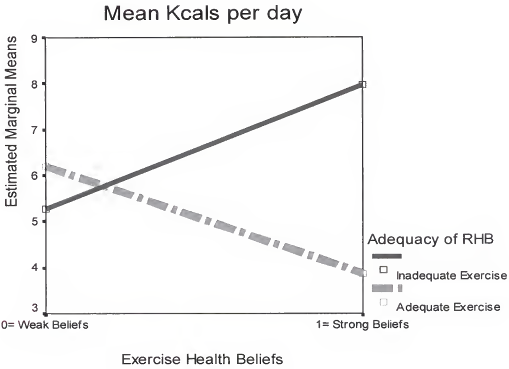

Figure 4. Domain-Specific Interaction B for Exercise

The interaction between Health Beliefs and Perceived Adequacy of the relative's health behavior suggests that the adequacy of the relative's behavior has no effect on the adolescent's behavior when health beliefs regarding the importance of exercise are weak. However, when health beliefs regarding exercise are strong, adolescents are more likely to exercise if they viewed their relative's exercise behavior as inadequate.

Diet

Total Calories (General Model). The General Model failed to reach statistical significance.

Total Calories (Domain Specific Model). The Domain Specific Model was significant, F(89)= 3.411, p = .007, R^2= .169, Adj R^2= .119; see Table 20 There were main effects for RHB (Diet) and Perceived Adequacy of the relative's diet. If the relative was described as a healthy eater, the adolescent tended to eat fewer calories. Similarly, if the adolescent viewed the relative's eating behavior as adequate, the adolescent tended to eat fewer calories. There was also a significant interaction between Diet Interconnectedness and Diet Health Beliefs, depicted in Figure 5.

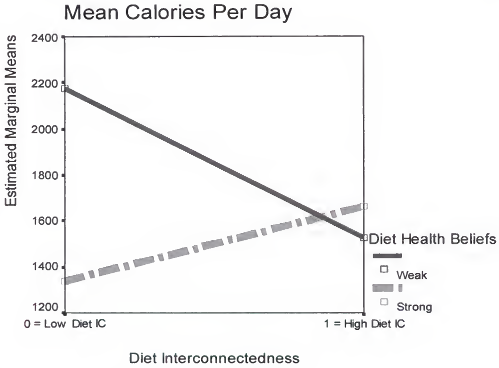

Figure 5. Domain-Specific Interaction for Total Calories

When Diet Interconnectedness was high, Total Calories consumed was minimally affected by Diet Health beliefs. When the participant demonstrated low Diet

Interconnectedness, the relationship was as expected, with strong Diet Health beliefs associated with decreased calorie consumption.

Percent of Calories from Fat (General Model). The General Model reached statistical significance F(89) = 3.6, p=.01, R^2= .144, Adj. R^2 = .103; see Table 21. Participants from Vanderbilt reported more of their calories from fat than participants from Florida. There was also a significant interaction between Overall Interconnectedness and General Health Beliefs (GHB), depicted in Figure 6.

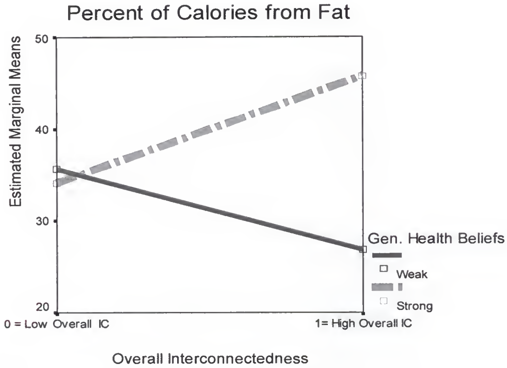

Figure 6. General Model Interaction for % Fat

When participants had low interconnectedness, there were no effects from health beliefs on percent of fat consumed. However when interconnectedness was high, those with strong health beliefs engaged in worse eating habits, consuming considerably more fat than those with low health beliefs.

Percent of Calories from Fat (Domain-Specific Model). The Domain-Specific Model was also significant, F(89) =3.1, p = .03 (R^2 = .099, Adj. R^2 = .067); see Table 22. The model included the interaction of Diet Interconnectedness * Perceived Adequacy of RHB, see Figure 7.

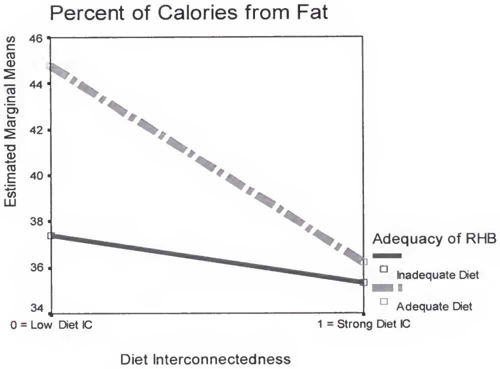

Figure 7. Domain-Specific Model Interaction for % Fat

When interconnectedness was high, the adolescent's perception of the adequacy of the relative's behavior had little influence on the adolescent's fat consumption. When interconnectedness was low, adolescents who viewed their relative as not eating appropriately tended to eat less fat.

Percent of Calories from Carbohydrates (General) The General Model reached statistical significance F(89) =2.5, p=.026, R^2 = .155, Adj. R^2=.094; see Table 23. Adolescents with Type 2 diabetes tended to consume a significantly greater percentage of calories from carbohydrates. In addition, there were two significant interactions with

General Health Beliefs. The RCS*GHB interaction is represented in Figure 8.0, while the Same Type * GHB interaction is represented in Figure 9.0.

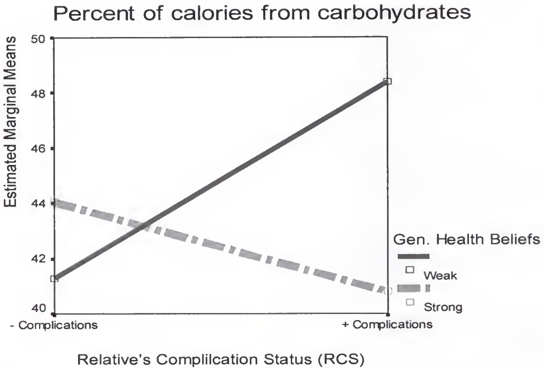

Figure 8. General Model A Interaction for % Carbohydrates

When health beliefs are strong, the presence of a diabetic complication in a family member appears to act as a suppressant, decreasing the adolescent's carbohydrate intake. However, when health beliefs are weak, the presence of a diabetic complication in the family member appears to act as a catalyst, resulting in increased carbohydrate consumption.

As shown in Figure 9, when the participant had the same type of diabetes as the relative, the relative's complication status had no effect on the adolescent's carbohydrate consumption. However, when the adolescent had a different type of diabetes, carbohydrate consumption increased when the relative had a complication.

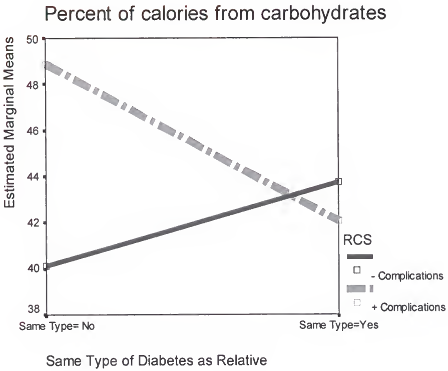

Figure 9. General Model Interaction B for % Carbohydrates

Percent of Calories from Carbohydrates (Domain-Specific Model). When General Model terms were replaced with the Specific Model variables for Relative Characteristics and Health Beliefs, the model failed to reach significance.

Concentrated Sugar (General Model) In considering the mean grams of concentrated sugars per meal, the General Model demonstrated significance, F(89) = 3.9, p=.002, R^2 = .221, Adj R^2= .165; see Table 24. Adolescents with Type 2 diabetes consumed significantly more concentrated sugar than did their Type 1 counterparts. Those who had fewer family members with diabetes consumed more sweets, and those who reported greater interconnectedness with their diabetic relative reported greater sweet consumption . In addition there was an interaction between relative complication status and general health beliefs, depicted in Figure 10.

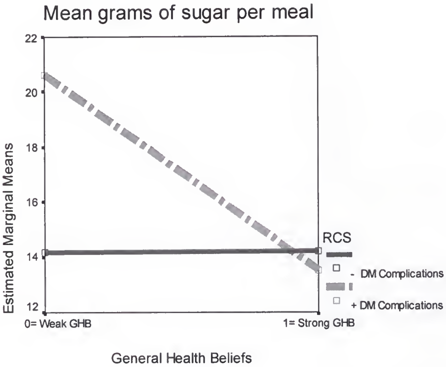

Figure 10. General Model Interaction for Grams of Sugar.

Having a family member with a diabetic complication was only a significant factor when health beliefs were low. The adolescent ate more concentrated sweets when the adolescent had weak general health beliefs and a relative with complications.

Concentrated Sugar (Domain-Specific Model)

The Domain Specific Model reached significance, F(89) =5.29, p <.001, R^2=.343, Adj. R^2= .278; see Table 25. Predictors of increased sweet consumption included: taller stature,; Type 2 diabetes, larger number of family members with diabetes, healthy eating by the relative and higher diet interconnectedness. The interaction term is illustrated in Figure 11.

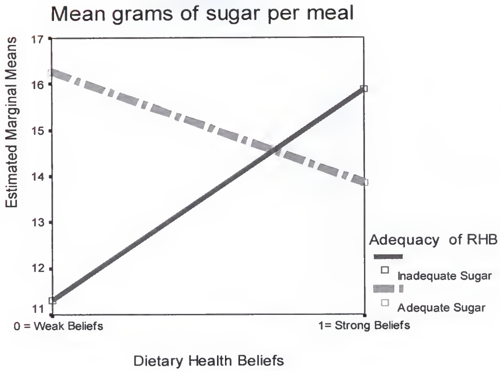

Figure 11. Domain-Specific Interaction for Grams of Sugar

Contrary to anticipation, those with weaker dietary health beliefs and who thought their relative's dietary behavior was inadequate demonstrated the best health behavior. On the contrary, when the relative's health behavior was perceived as adequate, the relationship was in the expected direction, as those with strong dietary beliefs exhibited more desirable health behavior by consuming less concentrated sugar. Thus, dietary health beliefs attenuated the effect of the perceived adequacy of the relative's sugar consumption.

Frequency of Meals (General Model). In predicting mean number of meals/snacks per day over the three interviews, the General Model reached significance, F(89) = 8.9, p<.001, R^2 = .406, Adj. R^2 = .361; see Table 26. Participants ate more frequently if they were younger, female, from the Florida campus, of higher SES, had

Type 1 diabetes, and had greater duration of disease, No family variables, relative characteristics or health beliefs were significant predictors

Meal Frequency (Domain-Specific Model). The Domain Specific Model also reached statistical significance, F(89) = 6.8, $p < .001$, R^2 of .451, Adj. R^2 of .385; see Table 27. In addition to the demographics and disease variables that were predictors in the General Model, Diet Interconnectedness and Diet Health Beliefs interacted, depicted in Figure 12.

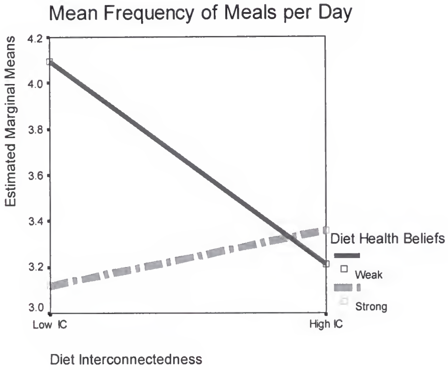

Figure 12. Domain-Specific Interaction for Meal Frequency

When health beliefs are strong, interconnectedness appears to exert little influence over meal frequency. However, when dietary interconnectedness is low, adolescents with strong diet health beliefs ate less frequently than those with weak beliefs.

Overview of Model Findings

In summary, both the General and the Domain-Specific Models proved to be useful. Beyond the variability accounted for by the Demographic and Disease Characteristic terms, both the General and Domain-Specific Models reached significance for 5 of the 8 (62.5%) outcome variables (Table 28). The amount of variance accounted for ranged greatly, with the least significant amount being Adj. R^2 =.067 and the greatest amount being Adj. R^2 =.385. In comparing the General and Domain-Specific Models, neither demonstrated an impressive edge over the other in the variance accounted for or number of outcome variables significantly explained / predicted.

A closer inspection of the variables themselves reveals RCS as the most active term, making a significant contribution on five different occasions (Table 29). The pattern of the data also suggests that the Family, Relative Characteristics, and Health Beliefs variables might be more useful in understanding the lifestyle outcomes (diet and exercise) versus the others behaviors (medication skipping and blood glucose monitoring)

Table 1. Demographics of Study Completers versus Incompleters

Variable	Incompleters (n=22) n	(%)	Completers (n=90) n	(%)
Disease Type				
Type 1	16	(72.7)	59	(65.6)
Type 2	06	(27.3)	31	(34.4)
Gender				
Male	09	(40.9)	35	(38.9)
Female	13	(59.1)	55	(61.1)
Ethnicity				
Caucasian American	18	(81.8)	57	(63.3)
African American	04	(18.2)	33	(36.7)
Campus				
Florida	11	(50.0)	27	(30.0)
Vanderbilt	11	(50.0)	63	(70.0)
SES				
Full Priced Lunch	16	(72.7)	66	(73.3)
Reduced Lunch	04	(18.2)	09	(10.0)
Free Lunch	02	(9.1)	14	(15.6)

Variable	M	(SD)	M	(SD)
Total # Family Members	2.23	(1.1)	2.77	(1.7)
Current Age [Years: M; (SD)]	16.08	(2.5)	15.32	(2.0)
Age at Diagnosis	10.11	(3.5)	9.58	(3.9)
Disease Duration	5.97	(3.4)	5.86	(3.5)
BMI kg/m^2	27.74	(8.6)	27.16	(7.6)
Hemoglobin A1c	8.71	(1.5)	8.98	(1.8)

Table 2. Demographics of Total Study Sample

Variable	n	(%)
Disease Type		
Type 1	59	(65.6)
Type 2	31	(34.4)
Gender		
Male	35	(38.9)
Female	55	(61.1)
Ethnicity		
Caucasian American	57	(63.3)
African American	33	(36.7)
Campus		
Florida	27	(30.0)
Vanderbilt	63	(70.0)
SES		
Full Priced Lunch	66	(73.3)
Reduced Lunch	09	(10.0)
Free Lunch	14	(15.6)
Initial Symptoms		
Increased Urination	78	(86.7)
Increased Thirst	69	(76.7)
Fatigue	69	(76.7)
Ketoacidosis	32	(35.6)
Initial Treatment		
Insulin	81	(90.0)
Oral Hypoglycemics	06	(6.7)
Combination (Insulin/pills)	02	(2.2)
Diet/Exercise Only	01	(1.1)
Current Treatment		
Injections only	68	(75.6)
Pump	09	(10.0)
Oral Hypoglycemics	05	(5.6)
Combination (Insulin/pills)	06	(6.7)
Diet/Exercise Only	02	(2.2)

Variable	M	(SD)
Total # Family Members	2.77	(1.7)
Current Age [Years: M; (SD)]	15.32	(2.0)
Age at Diagnosis	9.58	(3.9)
Disease Duration	5.86	(3.5)
BMI kg/m^2	27.16	(7.6)
Birth Weight [lbs.: M (SD)]	7.42	(1.5)
Birth Length [in.: M (SD)]	20.30	(1.4)
Hemoglobin A1c	8.98	(1.8)

Table 3. Total Sample Descriptives of Family Members with Diabetes

Variable	M	(SD)
Total # of Relatives	2.77	(1.7)

Variable	n	(%)
Diabetes Type		
Type 1	28	(31.1)
Type 2	53	(58.9)
Unknown	09	(10.0)
Deaths Related to Diabetes	08	(8.9)
Relationship to Subject		
Parent	20	(22.2)
Sibling	08	(8.9)
Grandparent	35	(38.9)
Uncle/Aunt	13	(14.4)
Cousin	07	(7.8)
Great…	07	(7.8)
Resided with Relative		
Never	47	(52.2)
Currently	35	(38.9)
Previously	08	(8.9)
Same Type of Diabetes	41	(45.5)

Variable	M	(SD)
# Years Shared Residence	11.1	(5.7)

Table 4. Sample Descriptives by Participant Disease Type and Ethnicity

TYPE 1

	Total (n = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	n	(%)	n	(%)	n	(%)
Gender						
Male	26	(44.1)	21	(45.7)	5	(38.5)
Female	33	(55.9)	25	(54.3)	8	(61.5)
Campus						
Florida	16	(27.1)	09	(19.6)	07	(53.8)
Vanderbilt	43	(72.9)	37	(80.4)	06	(46.2)
SES (Lunch Price Status)						
Regular	48	(81.3)	41	(89.1)	07	(53.8)
Reduced	05	(8.5)	04	(8.7)	01	(7.7)
Free	06	(10.2)	01	(2.2)	05	(38.5)
	M	(SD)	M	(SD)	M	(SD)
Age [years: M (SD)]	15.2	2.1	15.1	2.1	15.6	1.9
Age at diagnosis	8.3	3.4	8.3	3.9	8.2	3.4
Disease duration (yrs)	6.99	3.4	6.8	3.5	7.5	3.1

TYPE 2

	Total (n = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	n	(%)	n	(%)	n	(%)
Gender						
Male	09	(29)	5	(45.5)	4	(20)
Female	22	(71)	6	(54.5)	16	(80)
Campus						
Florida	11	(35.5)	2	(18.2)	09	(45)
Vanderbilt	20	(64.5)	9	(81.8)	11	(55)
SES (Lunch Price Status)						
Regular	19	(61.3)	08	(72.7)	11	(55)
Reduced	04	(12.9)	02	(18.2)	02	(10)
Free	08	(25.8)	01	(9.1)	07	(35)
	M	(SD)	M	(SD)	M	(SD)
Age [years: M (SD)]	15.5	1.9	15.2	1.4	15.6	2.1
Age at diagnosis	12.1	2.7	11.3	3.3	12.5	2.2
Disease duration (yrs)	3.4	2.2	3.9	2.9	3.1	1.6

Table 4 (continued).

	TYPE 1					
	Total (n = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	n	(%)	n	(%)	n	(%)
Initial Treatment						
Insulin	59	(100)	46	(100)	13	(100)
Initial Symptoms						
Increased Urination	53	(89.8)	41	(89.1)	12	(92.3)
Increased Thirst	54	(91.5)	43	(93.5)	11	(84.6)
Fatigue	43	(72.9)	33	(71.7)	10	(76.9)
Ketoacidosis	18	(30.5)	15	(32.6)	03	(23.1)
Current Treatment						
Injections only	50	(84.7)	38	(82.6)	12	(92.3)
Pump	09	(15.2)	08	(17.4)	01	(7.7)
	M	(SD)	M	(SD)	M	(SD)
Birth Weight [lbs.: M (SD)]	7.2	(1.4)	7.2	(1.5)	7.2	(0.9)
Birth Length [in.: M (SD)]	20.0	(1.2)	20.1	(1.2)	19.7	(1.6)
Current BMI (kg/m^2)	22.8	(3.3)	23.3	(3.1)	21.0	(3.5)
Hemoglobin A1c	8.9	(1.7)	8.8	(1.7)	9.1	(1.8)

	TYPE 2					
	Total (n = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	n	(%)	n	(%)	n	(%)
Initial Treatment						
Insulin	22	(71)	09	(81.8)	13	(65)
Oral Hypoglycemics	06	(19.4)	01	(9.1)	05	(25)
Combination	02	(6.4)	01	(9.1)	01	(5)
Diet/Exercise only	01	(3.2)	---	------	01	(5)
Initial Symptoms						
Increased Urination	25	(80.6)	11	(100)	14	(70)
Increased Thirst	29	(93.5)	11	(100)	18	(90)
Fatigue	26	(83.9)	10	(90.9)	16	(80)
Ketoacidosis	14	(45.2)	05	(45.5)	09	(45)
Current Treatment						
Insulin	18	(58.1)	08	(72.7)	10	(50)
Pills	05	(16.1)	---	-----	05	(25)
Pills + Insulin	06	(19.3)	03	(27.2)	03	(15)
Diet/Exercise	02	(6.4)	---	-----	02	(10)
	M	(SD)	M	(SD)	M	(SD)
Birth Weight [lbs.: M (SD)]	7.9	(1.6)	7.8	(1.3)	7.8	(1.9)
Birth Length [in.: M (SD)]	21.1	(1.5)	21.1	(1.7)	21.0	(1.5)
Current BMI (kg/m^2)	35.7	(6.2)	32.4	(4.0)	37.7	(6.4)
Hemoglobin A1c	9.2	(1.9)	9.2	(2.2)	9.1	(2.2)

Table 5. Participant Medication/Blood Glucose Testing Behavior by Disease Type & Ethnicity

TYPE 1

	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	M	(SD)	M	(SD)	M	(SD)
Prescribed Medication Freq.	2.8	(0.7)	3.0	(0.8)	2.2	(0.4)
% Medication Taken	92.64	(10.2)	92.21	(10.2)	94.14	(10.5)
	n	(%)	n	(%)	n	(%)
No Medication Skips	35	(59.3)	26	(56.5)	09	(69.2)
	M	(SD)	M	(SD)	M	(SD)
Frequency of BG Tests	3.3	(1.1)	3.3	(1.0)	3.2	(1.4)
Average BG Level	160	(40.0)	162.1	(41.1)	152.7	(36.5)

TYPE 2

	Total (n = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	M	(SD)	M	(SD)	M	(SD)
Prescribed Medication Freq.	2.2	(0.8)	2.3	(0.5)	2.2	(1.0)
% Medication Taken	90.1	(16.3)	86.2	(20.8)	92.46	(12.8)
	n	(%)	n	(%)	n	(%)
No Medication Skips	19	(61.3)	06	(54.5)	13	(65..0)
	M	(SD)	M	(SD)	M	(SD)
Frequency of BG Tests	2.1	(1.0)	2.1	(0.8)	2.1	(1.1)
Average BG Level	165.2	(41.6)	180.4	(39.6)	156.5	(41.1)

Table 6. Participant Diet and Exercise Behavior by Disease Type and Ethnicity

	TYPE 1					
	Total		Caucasian American		African American	
	(N = 59)		(n = 46)		(n = 13)	
Variable	M	(SD)	M	(SD)	M	(SD)
Meals Per Day	3.5	(0.6)	3.4	(0.6)	3.7	(0.9)
Total Calories Per Day	1593.3	(441.4)	1606.9	(453.7)	1558.5	(410)
% Calories from Fat/meal	36.5	(7.5)	37	(7.3)	34.4	(8.0)
% Calories from Carbs/meal	44.8	(7.8)	43.9	(8.1)	48.2	(6.2)
Mean Grams of Sugar/ meal	12.7	(6.2)	12.5	(6.5)	13.2	(5.5)
% Calories from Protein/meal	18.7	(10.6)	19.1	(11.4)	17.3	(7.3)
Exercise Frequency/day	0.8	(0.7)	0.7	(0.5)	1.1	(0.9)
Minutes of Exercise/day	52.3	(51.1)	45.3	(42.7)	77.0	(70.2)
Mean KCAL / activity	0.11	(.10)	0.12	(.12)	0.10	(.03)
Mean KCALs/day	15.8	(15.9)	13.4	(12.4)	24.2	(23.4)
Total Exercise Frequency	2.4	(2)	2.1	(1.6)	3.5	(2.7)
Total Minutes of Exercise	156.9	(153.4)	136.0	(128.3)	231.0	(210.6)
Total KCALs	15.8	(5.3)	13.4	(12.4)	24.2	(23.4)

	TYPE 2					
	Total		Caucasian American		African American	
	(n = 31)		(n = 11)		(n = 20)	
Variable	M	(SD)	M	(SD)	M	(SD)
Meals Per Day	2.98	(0.5)	2.9	(0.3)	3.0	(0.6)
Total Calories Per Day	1523.8	(389.9)	1540.7	(275.5)	1514.5	(447.1)
% Calories from Fat/meal	37.1	(6.0)	38.0	(6.5)	36.6	(5.8)
% Calories from Carbs/meal	47.0	(8.0)	47.4	(7.8)	46.8	(8.3)
Mean Grams of Sugar/meal	18.9	(10.7)	18.3	(6.0)	19.2	(12.7)
% Calories from Protein/meal	15.9	(7.0)	14.6	(7.0)	16.6	(7.0)
Exercise Frequency/day	0.7	(0.5)	0.8	(0.4)	0.7	(0.6)
Minutes of Exercise/day	70.1	(94.5)	55.2	(41.6)	78.4	(114.0)
Mean KCAL / activity	0.10	(.03)	0.10	(.03)	0.09	(.03)
Mean KCALs/day	6.3	(7.4)	5.9	(5.6)	6.5	(8.4)
Total Exercise Frequency	2.2	(1.6)	2.4	(1.2)	2.2	(1.8)
Total Minutes of Exercise	2104	(283.6)	165.4	(124.9)	235.1	(342.1)
Total KCALs	18.8	(22.4)	17.8	(16.9)	19.4	(25.3)

Table 7. Degree of Interconnectedness by Participant Disease Type and Ethnicity

TYPE 1

	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	M	(SD)	M	(SD)	M	(SD)
(%) Medication Taking	74.6	(32.9)	76.6	(31.8)	67.3	(37.3)
(%) BG Testing	72.9	(37.8)	73.9	(37.2)	69.2	(41)
(%) Exercise	82.6	(35.1)	86.4	(30.1)	69.2	(48)
(%) Diet	77.1	(38.6)	83.7	(34.2)	53.8	(45.4)
(%) Complications	81.4	(23.0)	82.3	(23)	78.3	(25.7)
(%) Overall	79.0	(23.4)	80.9	(21.1)	72.2	(30.1)

TYPE 2

	Total (N = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	M	(SD)	M	(SD)	M	(SD)
(%) Medication Taking	79.0	(32.3)	65.9	(35.8)	86.3	(28.6)
(%) BG Testing	88.7	(26.5)	81.8	(31.8)	92.5	(23.1)
(%) Exercise	92.7	(25.1)	88.6	(30.3)	95	(22.4)
(%) Diet	78.2	(40.2)	68.2	(46.2)	83.7	(36.5)
(%) Complications	86.4	(21.0)	83.4	(19.6)	88	(22.1)
(%) Overall	85.5	(22.9)	80.6	(23.0)	88.2	(23.0)

Table 8. General Health Beliefs by Participant Disease Type and Ethnicity

	TYPE 1					
	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	n	(%)	n	(%)	n	(%)
How important do you think a patient's behavior is in determining if a patient will get complications like kidney problems, loss of vision, or amputations?						
Not Important	---	-----	---	-----	---	-----
Somewhat Important	01	(1.7)	01	(2.2)	---	-----
Important	17	(28.8)	11	(23.9)	06	(46.1)
Very Important	37	(62.7)	30	(65.2)	07	(53.8)
Don't Know	04	(6.8)	04	(8.6)	---	-----
Do you think that people with diabetes can delay or stop complications from happening to them by doing what their diabetes doctors tell them to do?						
No	01	(1.7)	01	(2.2)	---	-----
Maybe	02	(3.4)	02	(4.3)	---	-----
Probably	19	(32.2)	13	(28.3)	06	(46.1)
Definitely	32	(54.2)	26	(56.6)	06	(46.1)
Don't Know	05	(8.5)	04	(8.6)	01	(7.7)
Do you think that your relative could delay or stop complications from happening by doing what his/her diabetes doctor said?						
No	02	(3.4)	01	(2.2)	01	(7.7)
Maybe	05	(8.5)	05	(10.8)	---	-----
Probably	22	(37.3)	18	(39.1)	04	(30.8)
Definitely	24	(40.7)	18	(39.1)	06	(46.1)
Don't Know	06	(10.2)	04	(8.6)	02	(15.4)
Do you think that you can stop or delay complications from happening to you by doing what your diabetes doctor tells you to do?						
No	01	(1.7)	---	-----	01	(7.7)
Maybe	01	(1.7)	01	(2.2)	---	-----
Probably	15	(25.4)	13	(28.3)	02	(15.4)
Definitely	42	(71.2)	32	(69.5)	10	(76.9)
Don't Know	---	-----	---	-----	---	-----

General Health Beliefs	M	(SD)	M	(SD)	M	(SD)
	2.29	(1.2)	2.3	(1.2)	2.2	(1.2)

Table 8 (Continued)

			TYPE 2			
	Total (N = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	n	(%)	n	(%)	n	(%)
How important do you think a patient's behavior is in determining if a patient will get complications like kidney problems, loss of vision, or amputations?						
Not Important	---	-----	---	-----	---	-----
Somewhat Important	02	(6.5)	01	(9.1)	01	(5.0)
Important	13	(41.9)	04	(36.4)	09	(45)
Very Important	15	(48.4)	06	(54.5)	09	(45)
Don't Know	01	(3.2)	---	-----	01	(5.0)
Do you think that people with diabetes can delay or stop complications from happening to them by doing what their diabetes doctors tell them to do?						
No	---	-----	---	-----	---	-----
Maybe	02	(6.5)	---	-----	02	(10)
Probably	12	(38.7)	06	(54.5)	06	(30)
Definitely	16	(51.6)	05	(45.4)	11	(55)
Don't Know	01	(3.2)	---	-----	01	(5.0)
Do you think that your relative could delay or stop complications from happening by doing what his/her diabetes doctor said?						
No	01	(3.2)	---	-----	01	(5.0)
Maybe	02	(6.5)	01	(9.1)	01	(5.0)
Probably	14	(45.2)	06	(54.5)	08	(40)
Definitely	11	(35.5)	04	(36.4)	07	(35)
Don't Know	03	(9.7)	---	-----	03	(15)
Do you think that you can stop or delay complications from happening to you by doing what your diabetes doctor tells you to do?						
No	---	-----	---	-----	---	-----
Maybe	02	(6.5)	---	-----	02	(10)
Probably	07	(22.6)	05	(25)	02	(10)
Definitely	22	(71)	06	(55)	16	(80)
Don't Know	---	-----	---	-----	---	-----
General Health Beliefs	M	(SD)	M	(SD)	M	(SD)
	2.1	(1.3)	1.9	(1.6)	2.2	(1.2)

Table 9. Domain Specific Health Beliefs by Participant Disease Type and Ethnicity

TYPE 1

	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	n	(%)	n	(%)	n	(%)
Importance of Medication						
Very Important	59	(100)	46	(100)	13	(100)
Fairly Important	---	-----	---	-----	---	-----
Not Important	---	-----	---	-----	---	-----
Importance of BG Testing						
Very Important	53	(89.8)	41	(89.1)	12	(92.3)
Fairly Important	05	(8.5)	04	(8.6)	01	(7.7)
Not Important	01	(1.7)	01	(2.2)	---	-----
Importance of Exercise						
Very Important	33	(55.9)	27	(58.7)	06	(46.1)
Fairly Important	26	(44.1)	19	(41.3)	07	(53.8)
Not Important	---	-----	---	-----	---	-----
Importance of Diet						
Very Important	52	(88.1)	41	(89.1)	11	(84.6)
Fairly Important	07	(11.9)	05	(10.8)	02	(15.4)
Not Important	---	-----	---	-----	---	-----

TYPE 2

	Total (N = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	n	(%)	n	(%)	n	(%)
Importance of Medication						
Very Important	29	(93.5)	11	(100)	18	(90)
Fairly Important	02	(6.5)	---	-----	02	(10)
Not Important	---	-----	---	-----	---	-----
Importance of BG Testing						
Very Important	28	(90.3)	09	(81.8)	19	(95)
Fairly Important	03	(9.7)	02	(18.2)	01	(5.0)
Not Important	---	-----	---	-----	---	-----
Importance of Exercise						
Very Important	17	(54.8)	04	(36.4)	13	(65)
Fairly Important	13	(41.9)	07	(63.6)	06	(30)
Not Important	---	-----	---	-----	---	-----
Importance of Diet						
Very Important	28	(90.3)	10	(90.9)	18	(90)
Fairly Important	03	(9.7)	01	(9.1)	02	(10)
Not Important	---	-----	---	-----	---	-----

Table 10. Relatives' Deaths and Hospitalizations by Participant Disease Type and Ethnicity

TYPE 1

	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	n	(%)	n	(%)	n	(%)
# Diabetes-Related Deaths for any Family Member						
None	53	(89.8)	41	(89.1)	12	(92.3)
One	03	(5.1)	02	(4.3)	01	(7.7)
Two	01	(1.7)	01	(2.17)	---	-----
Don't Know	02	(3.4)	02	(4.3)	---	-----
# Hospitalizations for Selected Family Member						
None	25	(42.4)	21	(45.6)	04	(30.8)
One	17	(28.8)	11	(23.9)	06	(46.1)
Three	01	(1.7)	01	(2.2)	---	----
Seven	01	(1.7)	01	(2.2	---	----
Don't Know	05	(8.5)	02	(4.3)	03	(23.1)
Reason for Hospitalization of Selected Family Member						
Onset of Diabetes	07	(11.8)	06	(13.0)	01	(7.7)
Diabetic Ketoacidosis	03	(5.1)	02	(4.3)	01	(7.7)
Eye Surgery	01	(1.7)	01	(2.2)	---	------
Hypo/Hyperglycemia	02	(3.4)	02	(4.3)	---	------
Leg Amputation	02	(3.4)	---	------	02	(15.4)
Stroke	---	------	---	------	---	------
Uncertain	03	(5.1)	01	(2.2)	02	(15.4)
RCS	M	(SD)	M	(SD)	M	(SD)
	0.4	(1.1)	0.2	(0.5)	1.1	(2.0)

TYPE 2

	Total (N = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	n	(%)	n	(%)	n	(%)
# Diabetes-Related Deaths for any Family Member						
None	25	(80.6)	10	(90.9)	15	(75)
One	03	(9.7)	----	-----	03	(15)
Don't Know	03	(9.7)	01	(9.1)	02	(10)
# Hospitalizations for Selected Family Member						
None	17	(54.8)	07	(63.6)	10	(50)
One	06	(19.4)	01	(9.1)	05	(38.5)
Two	01	(3.2)	01	(9.1)	---	-----
Don't Know	07	(22.6)	02	(15.4)	05	(38.5)
Reasons for Hospitalization of Selected Family Member						
Onset of Diabetes	04	(12.9)	01	(9.1)	03	(15.0)
Leg Amputation	04	(12.9)	01	(9.1)	03	(15.0)
Stroke	01	(3.2)	---	------	01	(5.0)
RCS	M	(SD)	M	(SD)	M	(SD)
	0.7	(1.1)	0.5	(.93)	0.9	(1.2)

Table 11. Relative's Microvascular Complications by Participant Disease Type and Ethnicity

TYPE 1

	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	n	(%)	n	(%)	n	(%)
Vision Complications						
Vision Problems	57	(63.3)	29	(72.5)	10	(76.9)
Problems b/c DM*	04	(6.8)	02	(7.4)	02	(15.4)
Eye Surgery	05	(8.5)	04	(9.3)	01	(7.7)
Surgery b/c DM	01	(1.7)	01	(2.2)	---	-----
Blindness	---	-----	---	-----	02	(15.4)
Blind b/c DM	---	-----	---	-----	01	(7.7)
Renal Complications						
Medication	03	(5.1)	03	(6.5)	---	-----
Dialysis	03	(5.1)	02	(4.3)	01	(7.7)
Diabetes Related Renal						
No	39	(66.1)	30	(65.2)	09	(69.2)
Yes	02	(3.4)	01	(2.2)	01	(7.7)
Don't Know	18	(30.5)	15	(32.6)	03	(23.1)

TYPE 2

	Total (N = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	n	(%)	n	(%)	n	(%)
Vision Complications						
Vision Problems	18	(58)	06	(54.4)	12	(60)
Vision b/c DM	07	(22.5)	01	(9.1)	06	(30)
Surgery	02	(6.5)	---	-----	04	(30.8)
Surgery b/c DM	02	(6.5)	---	-----	02	(10)
Blindness	01	(3.2)	---	-----	01	(5.0)
Blindness b/c DM	01	(3.2)	---	-----	01	(5.0)
Renal Complications						
Medication	03	(9.7)	01	(9.1)	02	(15.4)
Dialysis	02	(6.4)	---	-----	02	(15.4)
Diabetes Related Renal						
No	24	(77.4)	08	(72.7)	16	(80)
Yes	03	(9.7)	01	(9.1)	02	(10)
Don't Know	04	(12.9)	02	(18.2)	02	(10)

* DM= diabetes mellitus

Table 12. Relative's Macrovascular Complications by Participant Disease Type and Ethnicity

TYPE 1

	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	n	(%)	n	(%)	n	(%)
Cardiac Complications						
Hypertension	18	(30.5)	14	(41.2)	04	(30.8)
Stroke	05	(8.5)	03	(6.5)	02	(15.4)
Heart Attack	04	(6.8)	04	(8.6)	---	-----
Diabetes Related Cardiac						
No	33	(55.9)	26	(56.6)	07	(53.8)
Yes	02	(3.4)	01	(2.2)	01	(7.7)
Don't Know	24	(40.7)	19	(41.3)	05	(38.5)
Lower Extremity						
Problems	14	(15.5)	09	(19.5)	05	(38.5)
Removal/Amputation	03	(5.1)	01	(2.2)	02	(15.4)
Diabetes Related Lower Ext.						
No	41	(69.5)	32	(69.5)	09	(69.2)
Yes	08	(13.6)	05	(10.8)	03	(23.1)
Don't Know	10	(16.9)	09	(19.5)	01	(7.7)

TYPE 2

	Total (N = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	n	(%)	n	(%)	n	(%)
Cardiac Complications						
Hypertension	08	(25.8)	02	(18.2)	06	(30)
Stroke	02	(6.4)	01	(9.1)	01	(5.0)
Heart Attack	---	------	---	-----	---	-----
Diabetes Related Cardiac						
No	17	(54.8)	04	(36.4)	13	(65)
Yes	01	(3.2)	---	-----	01	(5.0)
Don't Know	13	(41.9)	07	(63.6)	06	(30)
Lower Extremity						
Problems	12	(38.7)	05	(45.4)	07	(35)
Removal/Amputation	03	(9.7)	01	(9.1)	02	(10)
Diabetes Related Lower Ext.						
No	20	(64.5)	07	(63.6)	13	(65)
Yes	08	(25.8)	03	(27.3)	05	(25)
Don't Know	03	(9.7)	01	(9.1)	02	(10)

Table 13. Relative's Medication Taking Behavior by Participant Disease Type and Ethnicity

TYPE 1

	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	n	(%)	n	(%)	n	(%)
Type of Medication						
Insulin	30	(50.8)	25	(54.3)	05	(38.5)
Pills	22	(37.3)	16	(35)	06	(46)
Both	01	(1.7)	01	(2.2)	—	—
None	03	(5.1)	02	(4.3)	01	(7.7)
Don't Know	03	(5.1)	02	(4.3)	01	(7.7)
	M	(SD)	M	(SD)	M	(SD)
# of Prescribed Meds.	1.9	(0.9)	2.0	(0.9)	1.3	(0.7)
	n	(%)	n	(%)	n	(%)
100% Compliance	27	(45.7)	21	(47.7)	06	(46.2)
Adequacy of Medication						
Too Much	01	(1.7)	01	(2.2)	—	—
Not Enough	04	(6.7)	04	(8.7)	—	—
About Right	40	(67)	32	(69.6)	08	(62)
Don't Know	14	(23.7)	09	(19.6)	05	(38)

TYPE 2

	Total (N = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	n	(%)	n	(%)	n	
Type of Medication						
Insulin	07	(22.6)	04	(36.4)	03	(15)
Pills	16	(51.6)	04	(36.4)	12	(60)
Both	03	(9.7)	---	-------	03	(15)
None	03	(9.7)	02	(18)	01	(5.0)
Don't Know	02	(6.5)	01	(9.1)	01	(5.0)
	M	(SD)	M	(SD)	M	(SD)
# of Prescribed Meds.	2.0	(1.1)	1.7	(1.5)	2.2	(.94)
	n	(%)	n	(%)	n	(%)
100% Compliance	11	(35.4)	04	(36.4)	07	(35.0)
Adequacy of Medication						
Too Much	—	—	—	—	—	—
Not Enough	02	(7.1)	---	-----	02	(10.5)
About Right	22	(78.6)	07	(70)	15	(79)
Don't Know	04	(14.3)	03	(30)	02	(10.5)

Table 14. Description of Relative's BG Testing by Participant Type and Ethnicity

TYPE 1

	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	M	(SD)	M	(SD)	M	(SD)
# BG Tests Prescribed	1.9	(.92)	2.0	(.92)	1.4	(.74)
	n	(%)	n	(%)	n	(%)
100% Compliance	36	(61)	31	(67.4)	05	38.5)
Adequacy of Testing						
Too Much	01	(1.7)	01	(2.2)	—	——
Not Enough	15	(25.9)	11	(24)	04	(30.8)
About Right	30	(51.7)	25	(56)	05	(38)
Don't Know	12	(20.7)	08	(17.8)	04	(30.8)

TYPE 2

	Total (N = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	M	(SD)	M	(SD)	M	(SD)
# BG Tests Prescribed	2.2	(1.8)	2.6	(1.2)	2.1	(2.1)
	n	(%)	n	(%)	n	(%)
100% Compliance	12	(38.7)	03	(27.3)	09	(45)
Adequacy of Testing						
Too Much	01	(3.8)	---	-----	01	(6.7)
Not Enough	06	(23.1)	02	(18)	04	(27)
About Right	17	(65.4)	08	(73)	09	(60)
Don't Know	02	(7.7)	01	(9.1)	01	(6.7)

Table 15. Description of Relative's Exercise Health Behavior by Participant Disease Type

TYPE 1

	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	M	(SD)	M	(SD)	M	(SD)
Hours of Exercise/Week	1.5	(3.4)	1.1	(2.3)	3.1	(6.3)
	n	(%)	n	(%)	n	(%)
# with any exercise	18	(30.5)	15	(32.6)	03	(23)
Adequacy of Exercise						
Too Much	03	(5.4)	02	(4.8)	01	(7.7)
Not Enough	27	(49.1)	20	(48)	07	(54)
About Right	13	(23.6)	12	(29)	01	(7.7)
Don't Know	12	(21.8)	08	(19)	04	(30.8)

TYPE 2

	Total (N = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	M	(SD)	M	(SD)	M	(SD)
Hours of Exercise/Week	1.2	(1.7)	1.7	(1.9)	.98	(1.7)
	n	(%)	n	(%)	n	(%)
# with any exercise	16	(51.6)	09	(81.8)	07	(35)
Adequacy of Exercise						
Too Much	---	----	---	----	---	------
Not Enough	15	(48.4)	05	(45)	10	(50)
About Right	14	(45.2)	05	(45)	09	(45)
Don't Know	02	(6.5)	01	(9.1)	01	(5.0)

Table 16. Description of Relative's Diet Behavior by Participant Disease Type and Ethnicity

TYPE 1

	Total (N = 59)		Caucasian American (n = 46)		African American (n = 13)	
Variable	M	(SD)	M	(SD)	M	(SD)
Fried Foods / Week	4.5	(4.8)	4.6	(5.1)	3.7	(2.5)
Adequacy of Diet (Fried)	n	(%)	n	(%)	n	(%)
Too Much	7	(11.9)	06	(13)	01	(7.7)
Not Enough	5	(8.5)	04	(8.7)	01	(7.7)
About Right	35	(59.3)	30	(65)	05	(38)
Don't Know	12	(20.3)	06	(13)	06	(46.2)
Sweets / Weeks	M	(SD)	M	(SD)	M	(SD)
	4.7	(5.9)	4.7	(6.1)	5.0	(5.3)
Adequacy of Diet (Sweets)	n	(%)	n	(%)	n	(%)
Too Much	14	(23.7)	12	(26.1)	02	(15.4)
Not Enough	01	(1.7)	01	(2.2)	---	------
About Right	33	(55.9)	27	(59)	06	(46)
Don't Know	11	(18.6)	06	(13)	05	(38)
Sweets + Fried < 3/wk	07	(11.9)	05	(10.9)	02	(15.4)

TYPE 2

	Total (N = 31)		Caucasian American (n = 11)		African American (n = 20)	
Variable	M	(SD)	M	(SD)	M	(SD)
Fried Foods / Week	2.3	(2.1)	1.3	(.95)	2.8	(2.3)
Adequacy of Diet (Fried)	n	(%)	n	(%)	n	(%)
Too Much	06	(19.4)	01	(9.1)	05	(25)
Not Enough	03	(9.7)	01	(9.1)	02	(10)
About Right	16	(51.6)	06	(55)	10	(50)
Don't Know	06	(19.4)	03	(27)	03	(15)
Sweets / Weeks	M	(SD)	M	(SD)	M	(SD)
	3.7	(5.0)	1.9	(2.4)	4.5	(5.7)
Adequacy of Diet (Sweets)	n	(%)	n	(%)	n	(%)
Too Much	05	(16.1)	02	(18.2)	03	(15)
Not Enough	03	(9.7)	02	(18.2)	01	(5.0)
About Right	16	(51.6)	03	(27)	13	(65)
Don't Know	07	(22.6)	04	(36.4)	03	(15)
Sweets + Fried < 3/wk	08	(25.8)	04	(36.4)	04	(20)

Table 17. Descriptive Model for Blood Glucose Monitoring

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
2	(Constant)	2.280	.200		11.373	.000
	Campus of Recruitment 0= Vanderbilt 1=Florida	-.576	.234	-.222	-2.456	.016
	Type of Diabetes: 0=Type 2 1=Type 1	1.187	.226	.475	5.252	.000

a Dependent Variable: Mean Number of BG Tests per day

Table 18. Final General Model for Exercise

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
3	(Constant)	7.266	1.429		5.085	.000
	Ethnicity 0=AA 1= CA	-2.434	1.320	-.193	-1.844	.069
	Same Type of Diabetes 0 = No 1=Yes	-.642	1.458	-.053	-.440	.661
	Relative's Complication Status (RCS) 0 = No Complications 1= Any Complications	4.179	1.908	.308	2.191	.031
	Same Type X RCS	-7.381	2.711	-.413	-2.723	.008

a Dependent Variable: mean kcals over the three days

Table 19. Final Domain-Specific Model for Exercise

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
4	(Constant)	6.335	1.704		3.717	.000
	Ethnicity 0=AA 1=CA	-2.689	1.345	-.213	-1.999	.049
	Same Type of Diabetes 0= No 1=Yes	-3.020	1.265	-.248	-2.388	.019
	Relative Complication Status (RCS) 0= No 1=Yes	3.772	1.813	.278	2.081	.041
	Relative's Health Behavior 0=No Exercise 1= Any exercise	3.871	1.768	.309	2.189	.031
	Perceived Adequacy of RHB 0= Inappropriate 1=Appropriate	1.807	2.142	.136	.844	.401
	Exercise Health Beliefs 0= All Other Responses 1=Very Important	1.661	1.480	.136	1.122	.265
	RCS * RHB (Exercise)	-6.349	2.795	-.329	-2.271	.026
	Exercise Health Beliefs * Perceived Adequacy	-5.504	2.756	-.338	-1.997	.049

a Dependent Variable: mean kcals over the three days

Table 20. Final Domain-Specific Model for Mean Calories/day Consumed

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
3	(Constant)	4287.664	1233.219		3.477	.001
	Relative's Health Behavior (RHB) 0 = Unhealthy 1= Healthy	-245.207	106.468	-.242	-2.303	.024
	Perceived Adequacy of RHB 0= Inadequate 1= Adequate	-218.603	95.730	-.254	-2.284	.025
	% of Diet Interconnectedness	-26.184	12.797	-2.408	-2.046	.044
	Diet Health Beliefs 0 = Weak 1= Strong	-2858.74	1236.790	-2.133	-2.311	.023
	Diet Interconnectedness* Diet Health Beliefs	29.815	12.950	3.174	2.302	.024

a Dependent Variable: mean calories per day

Table 21. Final General Model for Percent of Fat Consumed.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
4	(Constant)	47.042	4.754		9.896	.000
	Campus of Recruitment 0=Vanderbilt 1=Florida	-3.528	1.548	-.233	-2.279	.025
	General Health Beliefs (GHB)	-4.499	2.136	-.788	-2.106	.038
	Overall Interconnectedness (IC)	-.154	.059	-.513	-2.596	.011
	IC X GHB	.070	.026	1.214	2.731	.008

a Dependent Variable: percent of calories from fat

Table 22. Final Domain-Specific Model for Percent Fat Consumed.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	38.459	1.610		23.887	.000
	% of Diet Interconnectedness	-.031	.020	-.176	-1.551	.125
	Perceived Adequacy of RHB 0= Inadequate 1= Adequate	24.077	9.960	1.700	2.417	.018
	Diet Interconnectedness * Perceived Adequacy	-.235	.104	-1.607	-2.262	.026

a Dependent Variable: percent of calories from fat

Table 23. Final General Model for % of Calories from Carbohydrates

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
4	(Constant)	43.905	2.756		15.932	.000
	Type of Diabetes 0=Type2 1=Type 1	-4.374	1.835	-.264	-2.384	.019
	Same Type of Diabetes 0= No 1= Yes	3.160	3.320	.200	.952	.344
	Relative's Complication Status (RCS) 0= None 1= Any	8.102	4.066	.460	1.993	.050
	General Health Beliefs (GHB) 0= Weak 1= Strong	2.745	1.024	.423	2.680	.009
	RCS * GHB	-3.567	1.590	-.545	-2.243	.028
	Same Type * RCS	-2.820	1.329	-.505	-2.122	.037

Table 24. Final General Model for Concentrated Sweets

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
4	(Constant)	14.189	3.674		3.863	.000
	Type of Diabetes 0=Type Two 1= Type One	-5.795	1.865	-.313	-3.106	.003
	Total # of Family Members with Diabetes	-1.262	.559	-.242	-2.257	.027
	Overall Interconnectedness	.093	.042	.244	2.189	.031
	Relative's Complication Status (RCS) 0=No Complications 1=Any Complications	10.153	4.388	.517	2.314	.023
	General Health Beliefs (GHB)	.014	.823	.002	.017	.986
	RCS * GHB	-3.542	1.712	-.485	-2.069	.042

a Dependent Variable: mean grams of sugar per meal

Table 25. Final Domain-Specific Model for Concentrated Sweets

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
5	(Constant)	-28.260	16.011		-1.765	.081
	Height in inches	.479	.226	.198	2.117	.037
	Type of Diabetes 1= Type One 0= Type Two	-6.562	1.732	-.355	-3.789	.000
	# of Family Members with Diabetes	-.926	.514	-.178	-1.800	.076
	Relative's Health Behavior 0= No Excess Sweets 1= Excess Sweets	5.821	2.008	.297	2.899	.005
	% of Diet Interconnectedness	.085	.025	.373	3.335	.001
	Perceived Adequacy of RHB 0 = Inadequate 1 = Adequate	12.010	4.917	.681	2.443	.017
	Dietary Health Beliefs 0 = Weak 1 = Strong	10.005	4.185	.358	2.391	.019
	Diet Health Beliefs * Perceived Adequacy of (RHB)	-14.615	5.433	-.831	-2.690	.009

a Dependent Variable: mean grams of sugar per meal

Table 26. General Model for Meal Frequency

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	4.223	.489		8.642	.000
	Age	-.112	.032	-.331	-3.506	.001
	Campus of Recruitment 0=Vanderbilt 1=Florida	.541	.146	.352	3.707	.000
	Gender 0=Female 1= Male	-.481	.128	-.340	-3.746	.000
	SES (School Lunch Price) 0=Reduced/Free 1= Full	.433	.149	.269	2.906	.005
	Type of Diabetes 1= type one 0=type two	.380	.151	.258	2.516	.014
	Disease Duration	.042	.021	.207	2.020	.047

a Dependent Variable: mean frequency of meals

Table 27. Final Domain-Specific Model for Meal Frequency

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
4	(Constant)	7.422	1.816		4.088	.000
	Age	-.097	.032	-.287	-2.987	.004
	Campus of Recruitment 0=Vanderbilt 1=Florida	.554	.144	.360	3.848	.000
	Gender 0=Female 1= Male	-.407	.130	-.288	-3.142	.002
	SES (School Lunch Price) 0=Reduced/Free 1= Full	.402	.149	.250	2.701	.009
	Type of Diabetes 0 = Type Two 1= Type One	.384	.148	.260	2.591	.011
	Disease Duration	.031	.021	.155	1.479	.143
	% of Diet Interconnectedness	-.035	.018	-1.954	-1.888	.063
	Diet Health Beliefs 0 = Weak 1= Strong	-3.576	1.755	-1.664	-2.037	.045
	Diet Interconnectedness * Diet Health Beliefs	.037	.018	2.423	2.008	.048

a Dependent Variable: mean frequency of meals

Table 28. Variance Accounted for (Adj. R^2) by Model

	General Model	**Domain-Specific Model**
Medication Skipping	NS	NS
# of Blood Glucose Monitorings /day	*.277	*.277
Exercise (kcal)	.096	.115
Total Calories per day	.119	.103
% of Calories from Fat / meal	.096	.067
% of Calories from Carbohydrates / meal	.094	NS
Concentrated Sugar (g) / meal	.165	.278
Frequency of Meals/day	*.361	.385

*Only included Demographic and Disease Variables

Table 29. Specific Model Summary by Significant Main Effects and Interactions

	Medication Skipping		BG Testing		Exercise		Mean Calories		% Calories from Fat		% Calories from Carbohydrate		Concentrated Sweets		Meal Frequency	
	Main	Inter.	Main	Inter.	Main	Inter.	Main	Inter.	Main	Inter.	Main	Inter.	Main	Inter.	Main	Inter
DEMOGRAPHICS																
Age															G S	
Campus of Recruitment			G S						G						G S	
Ethnicity					S										G S	
Gender															G S	
SES															G S	
Height													S			
DISEASE																
Type of Diabetes			G S								G		G S		G S	
Disease Duration															G S	
FAMILY																
# Family with Diabetes													G			
Same Type of Diabetes					G S							G				
RCS					G	S						G		G S		
RELATIVE CHARACTERSISTIC																
Overall Interconnectedness										G			G			
Specific Interconnectedness								S		S			S			S
RHB						S	S						S			
Adequacy of RHB						S	S			S				S		
HEALTH BELIEFS																
General Health Beliefs										G		G		G		
Specific Health Beliefs						S		S						S		S

G= General Model S = Specific Model

CHAPTER 7
DISCUSSION

There were three major aims of this study. First, rather than viewing family history in the traditional light of "biological risk factor," we sought to examine its role as an explanatory force in understanding patient health beliefs and health behavior. Secondly, as we realize that the emergence of Type 2 diabetes in youths is a major epidemiological development, the need to secure descriptive information is evident. A major contribution of this study can be found in the richness of the descriptive information, as we sought to compare and contrast the health beliefs and health behavior of youths with Type 1 and Type 2 diabetes. As the literature suggests that there may be differences in health behavior and health status across ethnic groups, we also sought to examine this in Caucasian American and African American youths with Type 1 and Type 2 diabetes.

Over-sampling was successfully achieved, allowing sufficient sample size and power to examine the primary areas of interest. The intention to have 40% of the sample be African American was nearly achieved, as 36.7% of the sample was African American. This is a significant improvement compared to the majority of studies in this area where minority populations are severely underrepresented. Focusing on the recruitment and subject retention in this study, there was no evidence that minority participants were less likely to participate in research of this nature.

The goal of Type 2 participants representing 40% of the sample was nearly achieved, as 33.4% of the actual sample had Type 2 diabetes. Because Type 2 diabetes is still a recently recognized phenomenon, there continues to remain a strong need for information on this population. The inclusion requirement that subject be diagnosed with diabetes for at least one year was an obstacle for recruiting patients with Type 2 diabetes, as many of the youngsters presenting at the clinic were rather newly diagnosed and did not meet the disease duration requirement. This is a reflection of the newness of this phenomenon, as many clinics have only been engaging in screenings over the past two years for youths considered at risk for development of Type 2 diabetes.

Forty-eight percent of the participants had a history of living with their selected family members. This was important to ensure that a sufficient percentage of participants had enough exposure to their family members to have intricate knowledge of their health behaviors. The degree of closeness / knowledge about their relative's health behavior was expected to be a moderating factor in looking at the role of family history of diabetes on patient health beliefs and health behavior.

Demographics Variables

Many of the anticipated demographic differences across the disease types were evident. As expected, most Type 1 participants were Caucasian American and Type 2 participants were mostly African American. As obesity and sedentary life styles are identified as major risk factors for the development of Type 2 diabetes, it was no surprise that Type 2 youths had larger weight to height ratios, as measured by BMIs. The average BMI for Type 2 youths approached 35.7 kg/m^2, which is representative of the moderately obese range. This is in comparison with the 22.8 kg/m^2 of Type 1 youngsters, indicating a weight to height ratio that is within normal limits. The data gathered in terms of birth order, birth weight, and birth length revealed no significant differences across type of diabetes or ethnicity for birth weight or birth order. While Type 2 youths were shown to be significantly longer in birth length, the data did not support the notion that birth size predisposes youths to development of diabetes in general, or any specific form of diabetes, as the sample as a whole fell within normal limits for birth weight and length.

Type 1 participants averaged an earlier age of onset as expected. The mean age for the study sample was 8 years of age, which is somewhat younger than the national mean with a peak age of around 12 years old. Thus far, Type 2 diabetes in youths seems predominantly restricted to the adolescent years, and the mean age of onset for the study sample was around 12 years. Keeping in mind that prior to several years ago Type 2 diabetes was considered strictly an adult-onset disease form of diabetes, it appears that the increased obesity in Americans has resulted in Type 2 diagnosis in much younger ages.

From ethnicity, size and age of onset, it is initially easy to become transfixed by the glaring contrasts between the youths with Type 1 and Type 2 diabetes. However, the examination of numerous, relevant health behaviors and health beliefs highlights that the first major finding of this study is that these two groups are more similar than different.

Regardless of ethnicity or type of diabetes, the participants demonstrated “poor” diabetic control, as measured by HA1c results around 9.0%. The American Diabetes Association (ADA) recommends that HA1C levels be maintained below 7.0%, which is considered “good” metabolic control. Therefore, as a measure of health status, the two groups seem comparable, not supporting our hypothesis that Type 2 participants would be in poorer metabolic control than their counterparts. Likewise, metabolic control was also not shown to vary by ethnicity.

Additionally, initial symptoms reported at disease onset did not differ across disease types. The proportion of the sample reporting ketoacidosis as an initial symptom at the time of diagnosis, is similar to that typically found, ranging from 20 –40% (Rosenbloom and Hanas, 1996). However, it is surprising that youths with Type 2 diabetes reported a greater incidence of ketoacidosis at diagnosis than Type 1 participants reported.

Family History Variables: Interconnectedness, Health Behavior and Complications

Previous studies examining the influence of family health behavior on children and adolescents have primarily focused on the influence of parents (Lau, 1990; Doherty and Allen, 1994). However, this approach neglects the impact of other relatives. Most of the participants in this study had several family members who had some form of diabetes, ranging from 1 to 7 known family members with a history of diabetes. The current study was non-restrictive in the degree of relationship, allowing the participants to choose any family member to answer the interview questions about, thus allowing significant variability in the degree of closeness and knowledge about the history of family health behavior. Overall, the youths were able to offer an impression of their family member's health behavior about 80% of the time, indicating that they had significant awareness of their relative's health behaviors. This did not vary across type of disease or ethnicity. Additionally, substantial knowledge and impressions about the relative's behavior was seen across several degrees of relationship, indicating that youths have significant knowledge about extended family members and not just parents or those who live in the same home as them.

When the youths had an impression of their family member's health behavior, they seemed to present an inflated sense of compliance among family members. On average, the selected relative was rated to be about 95% compliant with the prescribed regimen. This is in stark contrast to the widely accepted and well documented observation that patients are typically about 50% compliant with multi-faceted, long-term treatment regimens for chronic conditions (Haynes, 1979). In terms of perceived adequacy, participants showed more discretion when rating if their family member's behaviors were appropriate, too little, or too much. In this respect, the participant's perceptions of their family member's health behaviors more closely resembled that which is traditionally found when examining compliance, as relative's were evaluated as having adequate health behavior about half of the time. Some variability was demonstrated here as family members were most thought to be behaving appropriately in regards to their medication taking, where 69% were rated as "about the right amount." Family members were seen as adequately testing their blood glucose levels about half the time (52.2%). These perceptions steadily diminished for the lifestyle areas of diet (40 % adequate) and diet (30% adequate).

The ability of diabetes to attack the body across so many systems is one of the things that makes the disease so devastating. Participants identified approximately one-third of the selected family members as having a diabetes-related complication. The areas of complication were diverse, with 8 participants having had a family member die secondary to diabetic complications. The reported prevalence of macrovascular (cardiac and cerebrovascular disease) and microvascular complications (retinopathy and renal failure) were similar in this sample. However, there were differences across ethnicity in the proportion of family members suffering from complications. In keeping with the literature suggesting that African Americans disproportionately suffer more morbidity than Caucasian American Americans, African Americans were found to account for the majority of the family member cases with identified diabetic complications, especially representing those identified as having multiple diabetic complications. However, a closer look at complications reveals an interesting trend.

The level of hesitancy or reluctance to attribute common diabetes-related complications to diabetes was striking, as participants often indicated "don't know" when asked if the complication was related to their relative's diabetes. While a total of 69 of the 90 selected family members had some type of health complication, only 36% of those complications were actually stated to be related to their diabetes. This finding was consistent across of both types of diabetes.

Interestingly, while the African Americans demonstrated more willingness to attribute illness morbidity directly to diabetes, The actual reporting of any and all complications, demonstrated similar rates across both ethnic groups: the selected family members were identified as having a health complication 78% and 75% of the time for Caucasian American and African American participants, respectively. However, African American participants were much more likely to attribute these complications to diabetes than their Caucasian American participants. Ultimately, upwards of 75% of all the selected family members had a health complication. However, Caucasian American participants only identified 25% of these complications as being diabetes related. This is in comparison to African American participants attributing more than twice as many complications to diabetes. Even though African Americans were more likely to attribute a complication to diabetes, they only identified about half (56%) of their relative's complications as being related to their diabetes. The need for increased education about how diabetes affects the various systems of the body and may manifest as complications needs to be stressed.

Consistent with the participants' perceptions that many relative complications were NOT the consequence of diabetes, the participants indicated that they are unlikely to develop complications themselves. Only 8 of the 90 subjects thought that they would "definitely" develop complications related to diabetes at some time in the future. However, the majority (60%) were willing to acknowledge that "maybe" they will develop complications down the road.

Health Beliefs: General and Domain - Specific

The participants indicated a fairly uniform impression that health behaviors are very important for the delay and/or prevention of health complications. They presented this as true not only for themselves, but for their relatives and the public in general. However, it is particularly interesting that while they endorsed strong beliefs regarding the connection between health behavior and health status, this pattern is not reflected by the information that they provided about their relatives. For example, while they tended to describe their relatives as compliant, a significant number of these same family members had experienced significant complications secondary to their diabetes.

There may be several explanations for this. The information gained about the relative's health behavior reflected the relative's current behavior and no inquiries were made regarding the relative's prior health behavior and level of compliance. The health status information reflected if the family member had any history of complications. Given this, it is possible that the health behavior and complication status seem to be incongruent because they indeed reflect different periods of the relatives' past. For example, a relative may now be compliant but only became so after non-adherence led to significant complications.

No information was assessed regarding how long the family member had been diagnosed with diabetes or had been suffering with a complication. Because many who have Type 2 diabetes experience a prolonged period of being asymptomatic prior to diagnosis, it is possible that many of the family members had developed complications prior to becoming aware that they had diabetes. If this is the case, then their history of health behavior since diagnosis, might have little to do with their complication status.

There is an additional possible explanation for the incongruence between health behavior and health status. During the interview, participants are asked if they believe that health behavior will "delay or prevent" complications. No information was assessed regarding the participants beliefs about when diabetic complications typically occur in the disease process or how long the family members have had diabetes. Perhaps the participants see their relatives as having delayed the onset of complications even though they have become afflicted with complications now.

By far, the majority of the participants believed that they could delay or prevent complications from happening if they were medically compliant, as $\geq$ 70% reported that they could "definitely delay or prevent" complications. When asked about the importance of various domains of the prescribed treatment regimen, the youths consistently rated the behaviors as "very important." There was little variability in their belief that medication taking, blood glucose monitoring, and diet were all crucial to delaying or preventing complications. Interestingly, across both disease types, the youths were less likely to believe that regular exercise was important in delaying or preventing complications.

Perhaps it would have been more helpful to have the participants rank order each domain-specific behavior in terms of most to least important.

Some instances in the literature have found that diabetes-related health beliefs among some ethnic/cultural groups have varied from those of the mainstream. In the present sample, this was not demonstrated, as both ethnic groups had similar views about the overall importance of health behavior in delaying or preventing complications. Likewise, there were no ethnic differences reported in the relative importance of domain specific health behaviors.

Outcome Variables

In terms of medication compliance for themselves, overall the participants reported a relatively high rate of approximately 90% compliance with frequency of medication taking. There was wide range of variability reported here (25 % to 100%), as several participants acknowledged their disregard for the prescribed regimen. While at times they seem to present an inflated image of compliance, when the information is assessed from another angle, the youth's openness can be seen through a willingness to admit to behaviors that are contrary to their prescription. Forty percent of the participants acknowledged skipping at least one of their prescribed medication doses.

Type 1 participants monitored their blood glucose significantly more frequently than their Type 2 counterparts, testing 3.3 times per day compared to 2.1 times. This is likely to be a manifestation of the disparity in the Standards of Medical Care for patients with diabetes promoted by The American Diabetes Association. In the ADA's position statement, there is a clear distinction made between what is the advised frequency of blood glucose monitoring in those with Type 1 versus Type 2 diabetes. The benefit of monitoring blood glucose levels prior to every administration of insulin has been clearly endorsed as a standard of practice for those with Type 1 diabetes. However, a similar standard has not been promulgated or demonstrated to be beneficial for adults with Type 2 diabetes. Furthermore, to date, the issue has not been widely examined for youths with Type 2 diabetes. Given this, the above noted discrepancy is likely to be an illustration of this uncertainty and lack of direction as well as a by-product of the increased frequency of prescribed medication taking for the Type 1 youngsters.

Across disease types and ethnicity, there were many similarities in nutrition for the youths. Their calorie consumption was similar with no differences in the total calories consumed or the percent of those calories coming from fat, carbohydrates, or protein. However, it is apparent that this sample generally underestimated their caloric intake. Perhaps in typical teenage fashion, over one third (36%) of all calories consumed were reported to come from fat. This was the same for Type 1 and Type 2 kids and also for Caucasian Americans and African Americans. This is in excess of the lower limit of 25% recommended by the American Diabetes Association (Nuttal and Brunzall, 1980). Participant also showed no differences in the total percentage of calories coming from carbohydrates. However, their ~46%, fell short of the upper limit set forth by the ADA of 60% of calories coming from carbohydrates. However, a closer examination demonstrates that more of the carbohydrates for Type 2 youths were from concentrated sweets. It appears that Type 1 youths ate more complex carbohydrates, as recommended by the ADA. According to the ADA recommendations, approximately 20% of calories should come from sources of protein. This is compared to the ~16% reported by the participants of the present study.

Another between group discrepancy can be found in the frequency of meals. According to the ADA, those with diabetes should consume three smaller meals during the day to be supplemented with snacks between meals. The information gathered here shows that Type 1 youth were more likely to modify their eating habits to reflect these guidelines, as they consumed the same amount of calories as their Type 2 counterparts, but also ate more times during the day. On the other hand, Type 2 participants were more likely to consume three large meals during the course of the day. However, there was a large range in the frequency of meals (1 to 5) reflected across disease types.

A review of the BMIs for the participants indicated that the Type 2 youths were generally moderately obese. However, they reported consuming the same amount of calories as the much smaller Type 1 youths. The exercise data does not reveal any significant differences between the groups. It would have been interesting to inquire how many of the participants were dieting in an attempt to lose weight. Perhaps this could explain the similar food intake reports and activity levels, but discrepant weight to height ratios.

There seems to be limited support here for the hypothesis that Type 2 youths engage in less desirable health behavior than their Type 1 counterparts. The diet data suggests that they have not altered their eating habits to the degree of Type 1 youths, consuming significantly more concentrated sweets. Additionally, they continue to eat three large meals instead of altering this to smaller, more frequent meals and they check their blood glucose levels less than Type 1 youths. However, across all other domains of disease management, there were no apparent differences between the two types.

Models

Medication Skipping

Neither the General nor Specific model was able to successfully predict to medication skipping. Therefore, no conclusion about medication skipping can be drawn at this time from the variables that were examined in the present study.

Blood Glucose Monitoring

In considering blood glucose testing, only demographic and disease variables were predictive: Campus of Recruitment and Type of Diabetes. For those with Type 1 diabetes, the American Diabetes Association has clear guidelines for blood glucose testing, recommending testing before insulin administration. However, there is currently no consensus on when or how often persons with Type 2 diabetes should test their blood glucose levels, especially if they are taking oral hypoglycemics rather than insulin. Therefore, as might be expected with this lack of a clear position, youths with Type 1 diabetes tested more frequently than Type 2 youths. This might also be related to the increased frequency of medication taking for the Type 1 youths compared to the Type 2 youths. Beyond differences between types of diabetes, those from Vanderbilt also tested more frequently than youths from Florida. Overall, it was type of diabetes that was overwhelmingly strong in explaining the frequency of blood glucose testing, as the Family, Relative Characteristics, and Health Beliefs variables were unable to significantly add to the model beyond the variance already accounted for by type of diabetes.

Exercise

In considering exercise, ethnicity was shown as a primary factor. The main effect demonstrated increased exercise for African American participants. There are instances in the literature, where minority participants demonstrate less compliance and less health behavior. However, the present study does not support this notion in the area of exercise, as the African American participants engaged in more desirable exercise behavior than their Caucasian American participants.

A review of the exercise models shows that when there was no family history of diabetic complications, it made no difference if the relative had the same type of diabetes or not, as participants demonstrated near equal energy expenditure. However, there were powerful effects if a diabetic complication was present. The direction of this association was somewhat surprising. The data illustrated that when the family member had a positive history of a diabetic complication, adolescents with a divergent type of diabetes tended to exercise more. In fact, a decline in exercise was likely for those who had the same type of diabetes as the relative with the diabetic complication. This relationship is at first puzzling. However, one could speculate that having a different type of diabetes, gives the participant hope for thwarting off the complications because they are not the same as their sick relative. Perhaps the negative effect demonstrated when the type of diabetes is the same as the relative's suggests an over-identification with the relative. The participant may feel as though he/she is the same as their relative and therefore likely to suffer the same fate of inevitable complications. This line of thinking could result in an abandoning of preventive measures to secure a different outcome than that of the relative.

The Specific Model also suggested that relative complications status is an important factor. When the relative had a complication the adolescent perceived as related to the relative's diabetes, the youth tended to act in a manner opposite of that demonstrated by the relative. For example, when the sick relative was reported to engage in no exercise, the youth was more likely to then exercise. Likewise, if the sick relative was reported to engage in exercise, the youths were more likely not to exercise themselves. In this case, the presence of complications in the relative tended to act as motivation not to follow the relative's example. This notion is also supported by the interaction between Exercise Health Beliefs and Perceived Adequacy of the relative's exercise. Those who indicated little belief that exercise is important in delaying or preventing complications are not affected by their evaluation of their relative's health behavior. However, for those with strong convictions of exercise's importance in disease prevention, the relative's behavior was an influential factor. When the relative's exercise was viewed as inadequate, the participants in turn increased their own exercise behavior. However, when the relative was seen as exercising adequately, the participant seemed somewhat more complacent about their own exercise behavior.

Mean Calories Per Day

First, in considering daily caloric intake, it is important to reiterate the present samples obvious tendency to underreport / underestimate their true caloric intake. It is not the impression of the researcher that this sample mostly represents under-eaters. That being said, the model demonstrates a seemingly straightforward relationship between family modeling of diet behaviors and the participant's diet. When the relative's diet tended to be unhealthy, the participant also leaned in that direction, consuming considerably more calories. Even when the participant saw their relative's health behavior as inadequate, they tended to consume substantially more calories, than those whose family member's diets were considered adequate. Dietary interconnectedness and dietary health beliefs, as low/weak levels in these categories combined to result in increased consumption of calories.

Concentrated Sugar

Consumption of concentrated sweets is one of the few places among the outcome variables of interest where type of diabetes is an obvious factor. Type 2 youths consumed significantly more diabetes than Type 1 youths. There is a general acceptance that diet is strongly associated with obesity and that obesity is a major risk factor for the development of Type 2 diabetes. Given this, it is not surprising that the Type 2 youths would demonstrate poorer dietary behavior. There was also a positive association between consumption of concentrated sweets and height of the participant. Height was included in the model as an indication of the child's stature, in an effort to control for those who were simply larger by stature, eating more than those of smaller stature. In addition to type of diabetes and height, eating more sugar was also found to be positively related to having fewer family members with diabetes. This is an unanticipated association and the ability to understand why such a relationship might manifest is limited.

The addition of considering the family's diet behavior in the Domain-Specific model adds more insight about the family's influence on the participant. Again it appears that family modeling is a strong factor in diet, as excessive sugar consumption on the part of the family member was positively associated with more sugar consumption for the participant. Also, on this same line of thinking, when the participant was closer to the family member, knowing more about their health behavior, the participant also tended to consume more sugar.

Once again RCS is evidenced as a major contributor to understanding the health behavior of the participants. Those with a family history of complications, having weak general health beliefs yielded an excessive degree of concentrated sugar intake. The weak health beliefs apparently inhibit the youngster from associating sugar intake with the development of complications. However, examination of the Specific model shows weak health beliefs in the opposite role as weak health beliefs actually resulted in decreased sugar consumption, when the relative's sugar consumption was thought to be inappropriate.

Percent of Calories from Carbohydrates

As would be expected given the increased consumption of sugar in Type 2 diabetes, this also resulted in increased overall carbohydrate consumption in comparison to those with Type 1 diabetes. In considering the percent of calories from carbohydrates, One explanation for such a pattern is that this simply illustrates the confusion about diet recommendations for persons with diabetes. It is a well notion that carbohydrate consumption is likely to result in elevated blood sugars. The data may be illustrating this tendency to associate increased carbohydrates with negative health behavior. In the General Model, when the relative had a complication, those with strong health beliefs consumed fewer carbohydrates, growing even more discrepant than the ADA recommendations of receiving 60% of calories from carbohydrates. This could again be associated with an effort to control blood sugar levels by restricting carbohydrate intake.

Percent of Calories from Fat

In the General Model, participants from Vanderbilt tended to consume more calories from fat compared to participants from Florida. When examining the results regarding fat, one sees an effect in the opposite direction than anticipated when interconnectedness and health beliefs are both high. Here, the data clearly demonstrates that as diet health beliefs become stronger, the highly interconnected participants consumed considerably more calories from fat. It could be that in an effort to minimize carbohydrate consumption because of its clear association with elevated blood glucose, those with strong diet health beliefs are left to gain more calories from fat sources in the absence of carbohydrates. After all, once carbohydrates are diminished as a source of calories, the next likely candidate for the average person is typically fat grams.

In the Specific Model, diet interconnectedness and perceived adequacy interact with each other. When the relative's health behavior was seen as inadequate, interconnectedness was not significantly influential. However, when the relative's health behavior was evaluated as adequate, being distant from the relative with less interconnectedness resulted in increased fat consumption.

Meal Frequency

For this outcome variable, a large portion of the variance was accounted for by demographic and disease factors. The younger participants ate more frequent meals, as the older teens tended to forego the in-between meal snacking as recommended by the ADA. Females were more likely to eat more frequent meals throughout the day. Again Type 1 participants seemed to follow the ADA recommendations for diet more closely than their Type 2 participants, as Type 2 participants tended to continue eating three larger meals per day. Having a higher SES and longer disease duration were also associated with eating more frequent meals.

In line with the previously mentioned notion regarding confusion about ADA eating habit recommendations, strong diet health beliefs were negatively associated with the healthiest behavior when meal frequency is examined. Intuitively, most people consider eating more meals to be a negative health behavior. This is especially true in these current times of excess and constant bombardment by the media that Americans are eating too much. It appears that the average participant in this study also falls into this belief. However, per the recommendations of the ADA, this is a false belief. In the case of someone with diabetes, more frequent eating is what is recommended in an effort not to flood the system with more than it can process effectively at one time. Three meals per day with snacks interspersed is the current recommendation. Despite this, those with strong diet health beliefs appear to continue to cleave to the intuitive concept that less eating is better for your health.

Summary

A review of the models found in Table 29, demonstrates some interesting patterns. First, the family variables, relative characteristics, and health beliefs all appear much more useful in predicting the outcome variables that were lifestyle behaviors. In fact, none of these predictor variables were significant in explaining the outcome variables that were not lifestyle related (medication skipping and blood glucose testing). Granted, the behaviors of medication taking and blood glucose testing are also complex behaviors, but the present study only examined them in crude fashion. There were many medication related factors that were not considered. For example unstudied medication factors included type of medication (different insulin types, pumps vs. injections, insulin vs. oral hypoglycemics, and timing of medication administration). For blood glucose testing, no data was considered from downloadable meters. Additionally, no consideration was given to when blood glucose testing occurred in respect to medication taking or eating. Perhaps more information would have been gleaned if medication and blood glucose testing were examined in a more comprehensive manner.

Especially in considering the lifestyle factors, the tendencies of the data support the rationale for using two models, suspecting that people behave in a varied manner across domains of disease management. The data asserts the importance of family variables in understanding patient health behavior. The persistent occurrence of statistically significant Family Variables and Relative Characteristics throughout the lifestyle models flies against the common practice of typically viewing family history of disease as a mere risk factor. There was considerable evidence that family history of disease is not only capable of directly influencing patient health behavior, but often interacts in complex relationships with other variables, such as health beliefs. Understanding this much allows one to appreciate how limited our insight is regarding the expression of family history influence on current patient behavior. On several occasions, the interactions involving family terms were surprising, curious, and unexpected, thus demonstrating how limited our current understanding is of the diverse ways in which family history of disease comes into play when attempting to understand patient health behavior.

The findings were unclear regarding which model, if either, was superior to the other. In the case of Medication Skipping and Blood Glucose Monitoring, neither model was impressive. The General Model demonstrated the edge in explaining percent of calories from fat grams and percent of calories from carbohydrates. However, for exercise, the Domain-Specific Model demonstrated a small gain over the General model in variance explained. This was likewise the case in considering mean calories per day, consumption of concentrated sugar, and frequency of meals per day. While the variance accounted for was not impressive in many instances, the Domain-Specific Model seems to have provided a better guide in conveying the complex relationships between relative behavior, complication status, and health beliefs

Hypotheses

Many of the anticipated differences between type of diabetes and ethnicity were demonstrated in the descriptive data. The data did not support the hypothesis that African American youths would engage in less desirable health behavior. There was some evidence, particularly in considering diet, that Type 2 youths engaged in less desirable health behavior, consuming more concentrated sugar and eating larger meals, without snacking.

It was hypothesized that Interconnectedness and patient health beliefs would act as moderators on the influence of RCS and RHB on the participant's health behavior. Instead of this notion being supported, interconnectedness and health beliefs often displayed a stronger relatedness, as their significant 2-Way interaction was demonstrated on multiple occasions. Likewise, Perceived Adequacy of RHB was a significant term even in the absence of the relative's health behavior being significant. The patterns demonstrated in the data suggest that perhaps Interconnectedness and Perceived Adequacy are greatly related to other factors that are less obvious at this point but perhaps more helpful in understanding the data. These tendencies in the data strongly warrant further investigation of these relationships.

Moreover, the frequency of trends in the data was noteworthy, as the predictive variables often approached significance, but failed to acquire it by the .05 or less cut-off. The limited sample size in the study may have been a prohibiting factor when testing for numerous possible, complex interactions. While the present study is one of few pioneers in exploring the explanatory role of family history, future development of more precise tools and approaches to examining family history will likely be very helpful in advancing out understanding.

Limitations

Despite its methodological soundness, the study has several limitations. First, the majority of the data was self-reported. Self-reported data may be inaccurate since retrospective reporting may lead to recall errors and omissions. Accounts of 24-hour food recalls in the literature suggest as much as 20% omission of calories actually consumed (Carter, Sharbaugh, & Stapell, 1981). Despite the focus on minority representation through inclusion of sufficient African Americans, other ethnic groups, especially those also experiencing an epidemic of Type 2 diabetes in youths, were not included. The need for additional studies, focusing on sufficient representation of these other groups is also important if the goal is to understand what makes some groups more susceptible and how to combat the increased complication rate in these populations.

Despite an effort to include every treatment domain (medication taking, blood glucose monitoring, exercise and diet), it was not possible to be all-inclusive. For example, in terms of diet we chose to examine eating frequency, total calories consumed, percent of total calories comprised of fat, carbohydrates, and protein, and consumption of concentrated sugars. While these variables are considered important for metabolic control, other dietary variable, such as timing of meals in relationship to medication-taking, may be important. The small sample size of the study prohibited the full examination of the complex relationships among the predictor variables. It was not possible to investigate the three way interactions of interest because of the inadequate cell sizes.

Lastly, much valuable information was likely lost, as the current study design required participants to choose only one of their family members about whom to answer health behavior and complication status questions. We recognize that there are multiple factors and relationships that could potentially influence the subject. It is conceivable that more explanatory and predictive information could have been obtained by considering what the youths knew about all of their family members who have diabetes. However, such an undertaking was beyond the scope of the present study.

Study Strengths

The present study is a methodological improvement on several points in comparison to similar studies in the literature. First, it is the only study in the literature that attempts to examine the explanatory role of family history, recognizing the family as a major source of learning and influence in terms of health beliefs and health behaviors. Second, this study examined all the components of the prescribed treatment regimen for individuals with diabetes. Previous studies have focused on only one aspect of the regimen, thereby resulting in an incomplete picture of health behavior and compliance. Third, a large proportion of the sample was African American, thereby increasing the ecological validity of the findings. Typically, studies in the literature have inadequate representation of ethnic minority groups. This is particularly detrimental as some ethnic groups, in this case African Americans, have been shown to be more at risk for the development of enduring morbidity and mortality subsequent to diabetes. Additionally, minority populations have a stronger prevalence of Type 2 diabetes, especially with the new emergence of Type 2 diabetes in young adults and adolescents.

Treatment Implications

While the data clearly indicates a strong need for continued research examining family variables, some treatment implications emerge for the here and now. There is an evident need for education across several areas, including how diabetes related complications are likely to manifest and how to implement the American Diabetes Association's dietary recommendations. However, knowing that education is not always sufficient to produce behavior change, the data provides some insight into other means to this end. One channel of facilitating change in youths with diabetes appears to be tapping into the power of the family. The data shows that what family members do and how they are perceived by youths with diabetes matters. While the biopsychosocial model has become more commonly applied to attempts of understanding patient disease and health behavior, there has been much less application of this perspective in treatment development. Involving the family system more readily into the treatment plans of youths through health behavior change and modeling may provide a much needed boost in fostering compliance, positive health behavior and improved health status.

APPENDIX A
DEMOGRAPHIC QUESTIONNAIRE

Name:________________________ Today's Date:____________ Date of Birth:___/___/_____

Please check the category that best describes you:

Caucasian or White ___
African American ___
Hispanic ___
Other ___

Male ___
Female ___

Type 1 (insulin dependent) ___
Type 2 (non-insulin dependent) ___
Other:____________________

Present Weight: ________
Present Height: ________
Weight at Birth:________
Length at Birth: ________

Please circle the number that best describes your birth order:

1st child
2nd child
3rd child
4th child
5th child
6th child
7th child
8th child
9th child
10th child
other:_____

Age when first diagnosed with diabetes: _______

Please **Circle** the type of treatment you received when first diagnosed with diabetes:

INSULIN ORAL HYPOGLYCEMICS (PILLS) OTHER:_____________

Please **Check** all the symptoms you had when first diagnosed with diabetes:

Frequent Urination ____
Increased Thirst____
Tiredness/Fatigue ____
Ketoacidosis ____

Please **check** the category that best describes your current school lunch status OR if you have already graduated from high school, please **check** the category of you lunch status during your last year of high school:

Free Lunch _____
Reduced Price _____
Regular Price _____

Please list all of your family members who have diabetes now or who have had diabetes in the past:

APPENDIX B
STRUCTURED FAMILY INTERVIEW

INTERVIEW:

When you signed up for this study you were asked to list all your family members who have diabetes. You listed (insert all relatives). Is there anyone else you can think of right now who you left off of this list?

We find that people differ in how they take care of their diabetes. For example, some people take insulin while others take pills. Some people check their blood sugar several times per day while other people rarely check. And people are different in terms of how much they exercise and what types of foods they eat. We are interested in knowing how much you know about what your relatives do to take care of their diabetes. So I am going to be asking you some questions about these things. If I ask you something that you don't understand just let me know and I will try to explain it. Also, I'm going to be asking a lot of questions, but I don't expect for you to know the answer to them all, so it's okay to say "I don't know." Okay?

Now one of the people that you listed was (insert relative)
A1. Is (insert relative) still alive?
If yes, go to B1 If no go to A2

A2. When did your (insert relative) pass away?
A3. What did your (insert relative) die from?
A4. Was that related to his/her diabetes?

B1. Have you ever lived with your (insert relative)?
If yes, When and for how long

B2. What type of diabetes does/did your (insert relative) have?
Of all of these people (list family members) who did you spend the most time with and know the most about. The following questionnaire should be completed with that relative in mind.

C1. Does he/she take any medication for their Diabetes?
If yes, go to C2 if No or DK go to D1

C2. Does your relative take insulin shots? Yes No
C3. Does your relative take pills for diabetes? Yes No
C4. How often is your (insert relative) suppose to take their medication?
C5. How often would you say your (insert relative) skips his/her medication?
____per day, ____ per week, ____per month, ____ per year
C6. Given that your (insert relative) has diabetes would you say that he/she takes medication :
Too much Not Enough or About the Right Amount

D1. Do you know if your relative does any exercise
(like walking, biking, or going to a gym)
If yes, go to D2 If No go to D6 If DK go to E1
D2. What type of exercise does your (insert relative) do?
D3. How often would you say that he/she does this?

__per day, __per week, ___ per month, __ per year
D4. For how long does your (insert relative) exercise
D5. Is that the only type of exercise that your (insert relative) does?
(Ask the same duration and frequency questions for each type of exercise)
D6. Give that your (insert relative) has diabetes, would you say that he/she exercises
Too much Not enough or About the right amount

E1. How often would you say that your (insert relative) eats fried foods like fried chicken, French fries, or fried fish – things like that ? *If DK got to F1*
__per day, __per week, ___ per month, __ per year

E2. Given that he/she has diabetes would say that he/she eat fried foods
Too much Not enough or About the right amount

E3. How often would you say that your (insert relative) eats sweets like cookies, cakes, pies, candy or drinks sweet drinks like regular sodas or sweet teas? *If DK go to F1*
__per day, __per week, ___ per month, __ per year

E4. Given that he/she has diabetes would you say that he/she eats or drinks sweets
Too much Not enough or About the right amount

F1. Is your relative suppose to check his/her blood sugar
If yes, go to F2 If No or DK Go to G4

F2. How often is your (insert relative) suppose to check his/her blood sugar?
__per day, __per week, ___ per month, __ per year

F3. How often does he/she skip or miss checking his/her blood sugar?
__per day, __per week, ___ per month, __ per year

F4. Would you say that your relative checks his/her blood sugar
Too much Not enough or About the right amount

G.1. Is your relative suppose to go to the doctor for diabetes check-ups?
If yes, go to G2 If No or DK, go to H1.
G2. How often?
G3. How often does (s)he ever miss or skip appointments?
G4. Do you think that (s)he goes to the doctor
Too much Not enough or About the right amount

Complication Assessment

Okay, now I am going to ask you some questions about your relative's health. Remember that you may not know all of the answers and it is okay to say "I don't know."

H1. Has your relative ever been in the hospital for anything?
If yes go to H2 If NO or DK go to I.1
H2. Why was he/she in the hospital?
H3. Did diabetes cause or have anything to do with that?
H4. Is that the only time that he/she have been in the hospital?
(ask the same questions for each time)

I1. Has your relative ever had problems with their eyesight or vision?
12. Is that because of diabetes?
13. Does he/she wear glasses?
14. Can he/she see okay with their glasses?
15. Has your relative ever had eye surgery?
16. Was that related to his/her diabetes?
17. Have he/she lost any of their vision or gone blind?
18. Was that related to diabetes?

J1. Has your (insert relative) ever had a heart attack?
J2. Has he/she ever had a stroke?
J3. Does he /she have high blood pressure?
J4. If yes to any : **Was that related to diabetes**

K1. Has he/she ever had problems with their feet, toes, or toenails
K.2. If yes, **Has he/she had any of them removed?**
K.3. If yes, **was that because of diabetes.**

L1. Has your relative ever had problems with their kidneys?
L2. If yes, did he/she have to take medication for their kidneys?
L3. Did he/she go on dialysis or use a machine to help their kidneys?
L4. Was that because of diabetes?

L5. Are there any other health problems that your relative has experienced because of diabetes?

In this next section, I am going to read you a question and give you some choices about how to answer that question.

M1. How important do you think a patient's behavior is in determining if a patient will get complications like kidney problems, loss of vision, or amputations.
Not Important Somewhat Important Important Very Important DK

M2. Do you think that people with diabetes can delay or stop complications from happening to them by doing what their diabetes doctor tells them to do?
No Maybe Probably Definitely Don't Know

M3. Do you think that your (insert relative) could delay or stop complications from happening by doing what his/her diabetes doctor said?
No Maybe Probably Definitely Don't Know

M4. Do you think that you can stop or delay complication from happening to YOU by doing what your diabetes doctor tells you to do?
No Maybe Probably Definitely Don't Know

M5. Do you feel as though you may get sick or develop complication because of your diabetes?
No Maybe Probably Definitely Don't Know

There may be some behaviors that you think are more important than others when it comes to stopping or delaying complications?

N1. How important would you say taking your insulin is in delaying or preventing complications?
Very Important Fairly Important Not Important

N2. How important would you say checking you blood sugar is in delaying or preventing complications?
Very Important Fairly Important Not Important

N3. How important would you say exercise is in delaying or preventing complications?
Very Important Fairly Important Not Important

N4. How important would you say watching what you eat is in delaying or preventing complications?
Very Important Fairly Important Not Important

N5. How important would you say regular doctor check-ups are in delaying or preventing complications?
Very Important Fairly Important Not Important

APPENDIX C
DEMOGRAPHICS BY CAMPUS OF RECRUITMENT

	Vanderbilt		Florida	
Variable	n	(%)	n	(%)
Female	38	60.3%	17	63.0%
Male	25	39.7%	10	37.0%
African American	17	27.0%	16	59.3%
Caucasian American	46	73.0%	11	40.7%
Full price	50	80.6%	16	59.3%
Reduced	6	9.7%	3	11.1%
Free	6	9.7%	8	29.6%

	Vanderbilt			Florida		
	N	Mean	(SD)	N	Mean	(SD)
age	62	14.9039	1.8330	26	16.3111	2.1682
body mass index (kg/m2)	62	26.8668	7.5049	27	27.8340	7.9965
weight at birth	55	7.4499	1.5885	16	7.3184	1.1914
length at birth	43	20.2093	1.3605	13	20.6154	1.5432
age at diagnosis	63	9.10	3.62	27	10.70	4.28
disease duration	62	5.8232	3.5765	26	5.6572	3.3510
Total # of Family Members listed with Diabetes	63	2.76	1.68	27	2.78	1.76
hemoglobin A1c	57	8.8653	1.8816	26	9.2500	1.6199

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BIOGRAPHICAL SKETCH

Rwanda LaToya Aker was born in Rome, Georgia, on June 8, 1973, to Waymond Roscoe Aker, Sr., and Sandra Gail (McCoy) Aker. She has one older brother, Waymond R. Aker, Jr. She spent the first four years of her life in Curryville, Georgia, and then relocated to Rockmart, Georgia, which she considers home. It was there that she graduated 3rd in her high school class, while participating in a host of extracurricular activities. These experiences set the foundation that allowed her to accept a full academic scholarship to Jackson State University, in Jackson, Mississippi. She excelled there, graduating summa cum laude with a bachelor's degree in psychology. While pursuing her doctorate at the University of Florida, she also completed a one-year internship at Vanderbilt University/ Nashville VAMC (Nashville, TN) and a two-year fellowship at the Cleveland Clinic (Cleveland, OH).

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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